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LIVESTOCK AND THE ENVIRONMENT

A BIBLIOGRAPHY WITH ABSTRACTS. VOLUME II

EAST CENTRAL STATE UNIVERSITY

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LIVESTOCK AND THE ENVIRONMENT

A Bibliography with Abstracts

Volume II

By

Ralph H. Ramsey, Ph.D.
M. L. Rowe
Linda Merryman
Animal Waste Technical
Information Center
School of Environmental Science
East Central Oklahoma
State University
Ada, Oklahoma 74820

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Project Officer

R. Douglas Kreis
Robert S. Kerr Environmental Research Laboratory
P. O. Box 1198
Ada, Oklahoma 74820

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ABSTRACT

Management and research information on animal wastes has expanded rapidly in recent years. This material has appeared in such diverse sources as journal articles, conference papers, university publications, government publications, magazine articles, books or book chapters, and theses. This bibliography was compiled in order to speed the flow of information on findings in one segment of the livestock industry to other segments that could benefit from this technology.

Included in this publication are the following indexes: (1) title, (2) author, (3) keyword, (4) animal information categories. These indexes are followed by a section of abstracts of each reference entry found in the bibliography. Single copies of most articles can be obtained in hard copy or microfiche form at cost from the Animal Waste Technical Information Center, School of Environmental Science, East Central Oklahoma State University, Ada, Oklahoma 74820.

This report was submitted in fulfillment of Grant Number R801454 by the School of Environmental Science, East Central Oklahoma State University, Ada, Oklahoma under the sponsorship of the Environmental Protection Agency. The work was completed as of January 31, 1975.

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Management and research information on animal wastes has expanded rapidly in recent years. This material has appeared in such diverse sources as journal articles, conference proceedings papers, university publications, government publications, magazine articles, books, and theses. This bibliography was compiled in order to speed the flow of information on findings in one segment of the livestock industry to other segments that could benefit from this technology. Included in this publication are the following indexes: (1) title, (2) author, (3) keyword, (4) animal information categories. These indexes are followed by a section of abstracts of each reference entry found in the bibliography. Single copies of most articles can be obtained in hard copy or microfiche form at cost from the Animal Waste Technical Information Center, School of Environmental Science, East Central Oklahoma State University, Ada, Oklahoma 74820. (Ramsey-East Central)

17a. Descriptors

*Bibliographies, *Cattle, *Sheep, *Hogs, *Poultry, *Fish farming, *Feedlots, *Confinement pens, *Research and development, *Farm wastes, Waste identification, Waste treatment, Waste storage, Waste disposal, Agricultural runoff

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*Waste management, *Title index, *Author index, *Keyword index, *Animal information categories index

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SECTION I

INTRODUCTION

The evolving regulations and aims pertaining to the abatement and control of pollution have necessitated a timely and well-dispersed flow of pertinent information about the management and disposal of animal wastes. This is necessary so that capital investments in this area can be made on the basis of the most recent research and operational findings. Industry and manufacturing organizations or associations, in many activities, provide the channels through which this information can flow. The wide range in operation sizes and makeup, the nationwide dispersion of production units, the variations in climatic and geographical factors, and the dictates of the local or regional markets which are encountered in the production of animals or animal products make widespread dissemination of animal waste management information difficult. Common properties and characteristics of animal wastes enable technological transfers to occur in the production operations from one species to another. Publicizing the existence of information on practices or findings in one segment of the livestock production industry can initiate new innovations or spread the adoption of the new ideas to other segments of the industry.

The objective of this project is to aid in the dissemination and technological transfer of information on the management and disposal of animal wastes throughout the livestock industry. Identification and location of pertinent information generated in the production operations of poultry, swine, cattle, fish, and other animals of economic interest raised in open or confined systems is accomplished through searches of technical journals; books; theses; reports from private, state and federal agencies; papers given at meetings of professional societies or symposiums; and articles appearing in the trade or production-oriented "farm" magazines.

The search topics of specific interest include the physical and chemical characteristics of animal wastes (manures and other material contaminated by manures); the operational and cost aspects of handling, collection, treatment, storage, transport, utilization, and disposal of animal manures; and the economic and legal impact of these wastes on the problems of air, water, and solid waste pollution. The articles identified in the search are collected and reviewed to determine if the contents are relevant to the project objectives. Those articles that are considered to be of value for the livestock producer or research scientist engaged in animal waste activities are abstracted and added to the collection.

An updated bibliography of animal waste management information will by prepared annually. It will contain entries and abstracts for all new items maintained in the collection at the Animal Waste Technical Information Center.

It is anticipated that users of this bibliography will secure pertinent publications from local libraries or through interlibrary loan. However, single copies of most publications (those for which copying approval has been obtained from the copyright owners) may also be obtained upon request in hard copy or microfiche form at a cost-only fee from the following address:

Mrs. Linda Merryman, Project Librarian
Animal Waste Technical Information Center
School of Environmental Science
East Central Oklahoma State University
Ada, Oklahoma 74820

SECTION II

USER'S GUIDE

The entries in this bibliography have been assigned a specific cross reference code. The code number consists of nine digits (example 100-73-1069) arranged in the sequences of a three-digit class code, a two-digit number representing the year of publication or presentation, and a four-digit accession number identifying each article brought into the animal waste information collection. The first grouping identifies the class code of the document according to the following format:

Code	Class
100	Technical journal paper
200	Conference proceeding paper
300	University or government publication
400	Magazine article
500	Book or chapter from a book
600	Unpublished paper
700	Thesis

This publication consists of 5 sections: Bibliography, Author Index, Keyword Index, Animal Information Category Index, and Abstracts. An explanation of each section follows.

BIBLIOGRAPHY

This section lists the items by classes according to the code defined above. The articles within these classes are arranged first by year of publication and then by accession number.

Each entry in the bibliography includes the cross reference code, the author(s), the title of the entry, a list of keywords which help identify the contents of the material, and the bibliographic citation, An example of the format is shown at the top of the following page.

```
400 70 0351   FAULKNER G
              DAIRY-SET-UP FOR 200 COWS  KEYWORDS  LAGOON COSTS
              POWER FARMING  JANUARY 1970  38-39
```

AUTHOR INDEX

This index lists all the authors cited in the bibliography in alphabetical order. To the right of each author entry is the cross reference code of the article or articles with which he is identified. An example of the format is as follows:

DUFFER W R	200 70 0698
	300 71 1245
DUFFY M E	100 69 0265
DUGAN G L	100 72 0746
	100 73 1184
	300 70 0668

KEYWORD INDEX

This index consists of an alphabetical listing of significant words in an article or in the title of an article. To the right of the keyword are the first 85 characters contained in the title or the title and a listing of keywords, if the title is short. To the left of the keyword is the nine digit cross reference code of the article ascribed to by the keyword. The cross reference code allows the user to enter the bibliography or look up the abstract for additional information about the title. An example of this index format is:

300 72 1157	DESIGN	CANADA ANIMAL WAST
600 69 1005	DESIGN	FACILITY DESIGN KE
600 71 0272	DESIGN	A DOSING-SIPHON FO
100 62 0499	DESIGN-CRITERIA	MANURE LAGOONS DES
100 65 0366	DESIGN-CRITERIA	LIQUID HANDLING OF
100 69 0353	DESIGN-CRITERIA	OXIDATION-DITCH TR
100 71 0266	DESIGN-CRITERIA	CAGED LAYER PERFOR

ANIMAL INFORMATION CATEGORY INDEX

To provide a quick entry into the abstract holdings of the collection, an animal information code was developed. This code utilizes an alphabetical entry to signify a broad interest area and a numerical digit to designate a more specific topic under the broad interest area. Each abstract in the collection was classified according to this code and could be listed under the five most relevant categories. This can provide the user an easy entry into the abstract holdings pertaining to his information needs. It is anticipated that some potential users, after reading some of the abstracts listed under these categories, may identify some particular keywords of importance which can be utilized to enter the more comprehensive keyword index to identify abstracts which may pertain to his more specific information needs. The code utilized in this index is as follows:

CATEGORIES OF ANIMAL INFORMATION

Interest Area	Topic Area
A. Environmental Effects	1. General
	2. Surface Runoff from Animal Production Unit Operation
	3. Surface Runoff from Agricultural Watersheds
	4. Groundwater
	5. Odor
	6. Air
	7. Biocides
	8. Vectors
	9. Health
	10. Aesthetics
B. Management of Animal Production and Confinement Operations	1. General
	2. Liquid Systems
	3. Solid Systems
C. Characteristics of Animal Wastes	1. General
	2. Physical
	3. Chemical
	4. Biological
	5. Management's Impact On
D. Treatment Processes	1. General
	2. Physical
	3. Chemical
	4. Biological
E. Utilization and Disposal	1. General
	2. Land
	3. Reuse
	4. By-Product Recovery
F. General	1. Economics
	2. Legalities
	3. Institutional and Policy Needs
	4. Overviews, Trends and Projections
	5. Related Agricultural Operations

The entries in this index appear by accession number under the code number as found in the following example:

C 1

0001
0010
0023

ABSTRACTS

This section contains the abstracts of the information entries contained in the bibliography. Most of these abstracts have been published in Selected Water Resource Abstracts published by the Water Resources Scientific Information Center (2-82). Each entry, therefore, includes the title of the informational material, the bibliographic citation, the author or authors, keyword identifiers and descriptors, and the abstract. The abstracts are arranged sequentially by an assigned accession number which specifically identifies the article in the collection. To the right of the accession number are the animal information category code numbers assigned to the abstract entry.

SECTION III

BIBLIOGRAPHY

BIBLIOGRAPHY

100 57 1507 GRAU C R KLEIN N W
SEWAGE-GROWN ALGAE AS A FEEDSTUFF FOR CHICKS KEYWORDS ALGAE FEEDS POULTRY PROTEINS ALUMINUM FLOCCULATION CENTRIFUGATION NEUTRALIZATION CHICKS SEWAGE-GROWN ACID-EXTRACTION TOLERANCE
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100 61 1390 CALLANTINE M R STOB M ANDREWS F N
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100 66 1344 GELDREICH E E CLARKE N A
BACTERIAL POLLUTION INDICATORS IN THE INTESTINAL TRACT OF FRESHWATER FISH KEYWORDS BACTERIA FRESHWATER-FISH COLIFORMS SAMPLING TEMPERATURE BACTERIAL-POLLUTION-INDICATORS INTESTINAL-TRACT FECAL-COLIFORMS STREPTOCOCCI LITTLE-MIAMI-RIVER
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COLIFORM BACTERIA IN CHICKEN BROILER HOUSE DUST AND THEIR POSSIBLE RELATIONSHIP TO COLI-SEPTICEMIA KEYWORDS COLIFORMS BACTERIA POULTRY DUSTS STRESS MORTALITY HUMIDITY FILTERS CHICKENS BROILER-HOUSE COLI-SEPTICEMIA AIR-SAMPLING
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WASTELAGE--SOMETHING NEW IN CATTLE FEEDING KEYWORDS FEEDS FARM-WASTES RUMINANT RECYCLING MICROORGANISMS DIGESTION CATTLE SHEEP FEED-LOTS WASTELAGE WASTE-MANAGEMENT
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100 69 1426 HOWE R H L
INDUSTRIAL WASTES-RESEARCH AND PRACTICE IN ANIMAL WASTES TREATMENT KEYWORDS FARM-WASTES WASTE-TREATMENT WATER-POLLUTION ON-SITE-INVESTIGATIONS CHEMICAL-PROPERTIES PHYSICAL-PROPERTIES WASTE-DISPOSAL LIVESTOCK BIOLOGICAL-TREATMENT LIQUID-WASTES SOLID-WASTES ANIMAL-PROCESSING-WASTES SLAUGHTERHOUSE
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QUALITATIVE CHANGES IN THE FISH-FAUNA OF THE UPPER NEOSHO RIVER SYSTEM 1952-1967 KEYWORDS FISH WATER-POLLUTION FEED-LOTS FARM-WASTES KANSAS UPPER-NEOSHO-RIVER FISH-FAUNA FISH-KILLS
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TREATMENT OF AGRICULTURAL WASTES KEYWORDS WASTE-TREATMENT FARM-WASTES LIVESTOCK SLURRIES LAGOONS OXIDATION-LAGOONS AERATION DRYING FOOD-PROCESSING-INDUSTRY IRRIGATION WATER-POLLUTION GREAT-BRITAIN
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100 72 1480 KIMBLE J M BARTLESS R J MCINTOSH J I VARNEY K E
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SEPTAGE WASTES PUMPED FROM SEPTIC TANKS KEYWORDS DOMESTIC-WASTES SEPTIC-TANKS SAMPLING VOLUME BIOCHEMICAL-OXYGEN-DEMAND CHEMICAL-OXYGEN-DEMAND PHYSICAL-PROPERTIES CHEMICAL-PROPERTIES MICROBIOLOGY MICROORGANISMS COSTS BACTERIA HYDROGEN-ION-CONCENTRATION ODOR COLOR SEPTAGE CONCENTRATION-RATIO
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200 72 1270 AGENA U
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200 72 1276 GRIMM A
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200 72 1301 MURPHY L S WALLINGFORD G W POWERS W L MANGES H L
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200 72 1302 SATTERWHITE M B GILBERTSON C B
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200 72 1303 MACMILLAN K SCOTT T W BATEMAN T W
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200 72 1304 ZWERMAN P J KLAUSNER S D BOULDIN D R ELLIS D
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200 72 1305 JONES P H PATNI N K
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200 72 1306 MULLIGAN T J HESLER J C
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200 72 1307 RIEMANN U
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200 72 1309 HEGG R O LARSON R E
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200 72 1310 CROWE R PHILLIPS R L
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200 72 1311 LUDINGTON D C SOBEL A T LOEHR R C HASHIMOTO A G
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200 72 1355 COE W B TURK M
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200 72 1356 KLOPFENSTEIN T KOERS W
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200 72 1357 SMITH L W
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D-LOTS REGULATION LEGAL-ASPECTS ENVIRONMENTAL-CONTROL WATER-POLLUTION-SOURCES PERMITS CATTLE HOGS POULTRY
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SKA POLLUTION EFFLUENT-APPLICATION WASTE-MANAGEMENT
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ING-POND
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BRICKS ARE BEING FORMED FROM MANURE AND GLASS KEYWORDS FARM-WASTES CATTLE RECYCLING WASTE-DISPOSAL DAIRY-INDUSTRY GLASS BRICKS MANURE BUILDING-MATERIALS
HOARD'S DAIRYMAN V 119 NO 1 JAN 10 1974 P 35

400 74 1371 ANON
FEEDERS IGNORE POLLUTION RULES-RISK STIFF FINES KEYWORDS FEED-LOTS REGULATION FINES PERMITS CATTLE WEATHER EQUIPMENT EFFLUENT WASTE-DISPOSAL RULES POLLUTION ENVIRONMENTAL-PROTECTION-AGENCY WASTE-MANAGEMENT DISCHARGES
BEEF V 10 NO 7 MARCH 1974 P 70-71 3 FIG

400 74 1432 ANON
COMPOSTED MANURE CALLED AVAILABLE FUEL SOURCE KEYWORDS FARM-WASTES FUELS RECYCLING WASTE-TREATMENT WASTE-DISPOSAL AEROBIC-BACTERIA THERMOPHILIC-BACTERIA SULFUR ORGANIC-WASTES PATHOGENIC-BACTERIA MOISTURE-CONTENT ODOR ENERGY COMPOST MANURE PYROLYSIS
FEEDLOT MANAGEMENT V 16 NO 4 APRIL 1974 P 28 30 1 FIG

400 74 1460 GRAVES R E
AN IN-DEPTH LOOK AT FEDERAL POLLUTION CONTROLS KEYWORDS REGULATION ENVIRONMENTAL-CONTROL FEED-LOTS LIVESTOCK POULTRY AGRICULTURAL-RUNOFF PERMITS WASTE-TREATMENT WASTE-DISPOSAL FEDERAL-WATER-POLLUTION-CONTROL-ACT FEDERAL-POLLUTION-CONTROLS ZERO-DISCHARGE ENVIRONMENTAL-PROTECTION-AGENCY
HOARD'S DAIRYMAN V 119 NO 9 P 614-653 1 FIG

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FEEDLOT MANAGEMENT V 16 NO 4 APRIL 1974 P 26

400 74 1502 ZINDEL H C
TURKEY ANAPHAGE KEYWORDS RECYCLING WASTE-TREATMENT CHEMICAL-ANALYSIS PERFORMANCE PHOSPHORUS PROTEIN NIT
ROGEN BACTERIA CALCIUM SAWDUST TURKEY-ANAPHAGE POULTRY-ANAPHAGE DRIED-POULTRY-WASTE POULTRY-LITTER MANURE
POULTRY DIGEST V 33 NO 384 P 73 76 3 TAB 1 FIG

400 74 1562 SOLLENBERGER G
REFEEDING FEED KEYWORDS RECYCLING FARM-WASTES FEEDS CATTLE FEED-LOTS POULTRY WASTE-DISPOSAL OXIDATION-DI
TCH WASTE-TREATMENT SILAGE PROTEINS SOLID-WASTES REFEEDING
THE FURROW V 79 APR 1974 P 12-13 3 FIG

400 74 1563 COUCH J R
RECYCLING DPW FOR GREATER RETURN KEYWORDS RECYCLING FEEDS POULTRY RUMINANTS PROTEINS NITROGEN PHOSPHORUS
FARM-WASTES WASTE-TREATMENT WASTE-DISPOSAL NUTRIENTS DPW DRIED-POULTRY-WASTES LAYING-HENS URIC-ACID MANU
RE
POULTRY DIGEST SUPPLEMENT V 33 NO 384 P A1-A7 4 FIG

400 74 1566 ANON
CORN MANURE AND SILAGE MAKE AN EXOTIC RATION KEYWORDS SILAGE FEEDS RECYCLING FARM-WASTES FEED-LOTS CATTL
E PERFORMANCE COSTS MANAGEMENT CORN MANURE REFEEDING
SUCCESSFUL FARMING V 72 NO 5 MARCH 1974 P B10-B11 5 FIG

400 74 1585 ANON
NEW LIQUID MANURE SYSTEMS KEYWORDS LIQUID-WASTES WASTE-DISPOSAL CONFINEMENT-PENS LAGOONS EFFLUENT ODOR C
OSTS MISSOURI DESIGN FARM-WASTES WASTE-TREATMENT MANURE FLUSH-SYSTEM
BEEF V 10 NO 8 APRIL 1974 P 37-38 2 FIG

400 74 1586 ANON
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A TENNESSEE ALUMINUM-SLATS CONCRETE-SLATS
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NUTRIENT RECOVERY NEW CONCEPT IN WASTE HANDLING KEYWORDS NUTRIENT-REMOVAL FARM-WASTES WASTE-TREATMENT RE
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ILIZATION WASTE-HANDLING REFEEDING
BEEF V 10 NO 7 MARCH 1974 P 74-76 1 TAB 6 FIG

400 74 1610 FLEMING B
TAILOR MADE CONFINEMENT BARN KEYWORDS FARM-WASTES CONFINEMENT-PENS MANAGEMENT FERTILIZERS DESIGN OXIDATI
ON-LAGOONS LAGOONS COSTS VENTILATION INSULATION WASTE-DISPOSAL WASTE-STORAGE ODOR BARNS LAND-SPREADING SL
ATS
BEEF V 10 NO 7 MARCH 1974 P 8-9 4 FIG

400 74 1612 WILBORN E
CAN WE REFEED FEEDLOT WASTES KEYWORDS RECYCLING FARM-WASTES FEED-LOTS CATTLE LIVESTOCK PERFORMANCE COSTS
ODOR WASTE-TREATMENT WASTE-DISPOSAL FEEDS REFEEDING
PROGRESSIVE FARMER V 89 NO 3 MARCH 1974 P 58 1 FIG

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SOME REFLECTIONS ON DRIED POULTRY WASTE KEYWORDS FARM-WASTES POULTRY DRYING RECYCLING FERTILIZERS FUELS
PERFORMANCE REFEEDING DRIED-POULTRY-WASTE-DPW
POULTRY DIGEST V 33 NO 385 MARCH 1974 P 118-121 13 TAB 2 FIG

500 72 1539 GOWAN D
SLURRY AND FARM WASTE DISPOSAL KEYWORDS SLURRIES FARM-WASTES WASTE-DISPOSAL LEGAL-ASPECTS SOILS ECONOMIC
S WATER-POLLUTION SAMPLING POULTRY LAGOONS HOGS WASTE-TREATMENT AERATION EQUIPMENT ODOR DISEASES CATTLE W
ASTE-STORAGE FERTILIZERS GREAT-BRITAIN LAND-DISPOSAL POLLUTION PUBLIC-HEALTH
SUFFOLK ENGLAND FARMING PRESS LIMITED 1972 244 P 37 TAB 44 FIG 12 REF

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DAIRY WASTE MANAGEMENT KEYWORDS DAIRY-INDUSTRY FARM-WASTES MANAGEMENT CALIFORNIA WATER-QUALITY WATER-POL
LUTION WASTE-DISPOSAL WATERSHEDS BACTERIA RUNOFF SALTS LEACHING RECYCLING EQUIPMENT ECONOMICS COSTS AIR-PO
LLUTION SANTA-ANA-RIVER-BASIN COMPOSTING SANITARY-LANDFILL
ALBERT A WEBB ASSOCIATES CONSULTING ENGINEERS RIVERSIDE CALIFORNIA MARCH 1974 177 P 36 TAB 36 FIG 44 REF

600 1383 DORMINEY R W WESWIG P H
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TECHNIQUES FOR THE ENUMERATION OF ANAEROBIC MICROBES IN WASTE FERMENTATION SYSTEMS KEYWORDS FARM-WASTES
ANAEROBIC-BACTERIA FERMENTATION WASTE-TREATMENT ANALYSIS EQUIPMENT DESIGN LIVESTOCK DISEASES POULTRY SAM
PLING MICROBES PLATING MANURE RUMEN
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FIG 4 REF

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PRIORITIES IN SELECTING DAIRY FACILITIES KEYWORDS FEED-LOTS INVESTMENT PRIORITIES FACILITIES DAIRY-INDUSTRY COSTS LAND WATER SILAGE FEEDS PLANNING CATTLE KENTUCKY WASTE-STORAGE WASTE-DISPOSAL MANURE-HANDLING FEED-STORAGE FIELD-MACHINERY
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PREPRINT COPY 12 P 27 REF

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EFFECT OF FEEDLOT LAWS AND CLIMATE ON OPEN FEEDLOT WASTE MANAGEMENT KEYWORDS FEED-LOTS REGULATION LEGAL-ASPECTS CLIMATES FARM-WASTES MANAGEMENT DESIGN COSTS PRECIPITATION-ATMOSPHERIC STORMS EVAPORATION WATER-POLLUTION IRRIGATION SOLID-WASTES STORM-RAINFALL OPEN-FEED-LOT HOLDING-POND
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AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS 66TH ANNUAL MEETING UNIVERSITY OF KENTUCKY LEXINGTON JUNE 17-20 1973 17 P 1 TAB 5 FIG 14 REF

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QUALITY DEGRADATION OF DAIRY WASHWATER KEYWORDS QUALITY-CONTROL DEGRADATION-DECOMPOSITION DAIRY-INDUSTRY GROUNDWATER-POLLUTION FARM-WASTES CATTLE WASTE-DISPOSAL EFFLUENT CHEMICAL-PROPERTIES PHYSICAL-PROPERTIES NITROGEN SALTS CHEMICAL-OXYGEN-DEMAND WASTE-WATER-POLLUTION-RETURN-FLOW CALIFORNIA WASTEWATER
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EFFECT OF CAGED LAYER MANURE ON PASTURE LAND KEYWORDS FARM-WASTES POULTRY PASTURES FESCUES FERTILIZERS CLOVERS RATES-OF-APPLICATION LITTER NORTH-CAROLINA COSTS FORAGE-GRASSES CAGED-LAYER-MANURE YIELD
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PAPER NO 74-5005 AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS 67TH ANNUAL MEETING OKLAHOMA STATE UNIVERSITY STILLWATER JUNE 23-26 1974 13 P 5 TAB 3 FIG 8 REF

700 66 1375 CONVERSE J C
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AUTHOR INDEX

ABBOTT E L	400	73	1341
ADAMS J B	200	72	1274
AGENA U	200	72	1270
	300	71	1476
ALBERT A WEBB ASSOC	500	74	1565
ALBIN ROBERT C	200	72	1296
ALETI A	600	74	1568
ANDERSON D F	200	72	1269
ANDERSON U P	100	68	1579
ANDERSON L L	300	72	1571
ANDERSON S	100	65	1573
ANDRE P D	100	73	1587
	400	73	1374
	400	74	1345
	400	74	1590
ANDREWS F N	100	61	1390
ANIMAL WASTE COMMITT	300	72	1503
ANON	100	70	1436
	100	71	1428
	200	71	1403
	200	71	1451
	200	72	1265
	200	73	1323
	200	73	1410
	200	73	1411
	400	70	1488
	400	72	1434
	400	72	1484
	400	72	1577
	400	72	1578
	400	73	1318
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	400	73	1545
	400	73	1572
	400	74	1348
	400	74	1371
	400	74	1432
	400	74	1497
	400	74	1566
	400	74	1585
	400	74	1586
ANTHONY W B	100	69	1316
APPELL H R	200	72	1359
AREF J	600	73	1365
ASHRAF M	600	73	1499
BABB M R	100	72	1553
BAIER D C	600	73	1365
BAKER D H	100	73	1437
BAKER R C	100	73	1402
BALDWIN L B	200	73	1328
BARBER E M	300	72	1425
BARKER J C	100	73	1574
	600	72	1398
BARTH C L	200	71	1547
	200	73	1329
BARTLESS R J	100	72	1480
BARTLETT H D	200	72	1299
BATEMAN T W	200	72	1303
BATES D W	200	73	1324
BAUGH E R	200	73	1317
BAUGHMAN G R	100	74	1525
BAULING D B	600	73	1397
BEATY E R	100	73	1450
BECK L A	100	70	1611
BELLMAN H E	200	73	1334
BENHAM C L	600	72	1595
BENNETT A	200	71	1452
BERG C W	600	73	1385
BERGDOLL J F	200	72	1288
BERRY J G	400	71	1482
BLACK J R	200	72	1272
BLACKMER A	200	72	1300
BLAIR B J	200	73	1510
	300	72	1561
BLAIR R	400	73	1549
BONNEAU W R	100	73	1558
BOORAM C V	200	73	1526
BOSCH J A	600	74	1543
BOSTON W D	600	73	1397
BOULDIN D R	200	72	1304
BOX J E JR	100	73	1450
BRAASCH M	100	69	1461
BRADLEY J	600	73	1521
BRADLEY J W	400	69	1523
BRESSLER G O	200	71	1405
BREVIK T J	200	73	1331
	200	73	1332
	200	73	1531
BRICKER C E	200	72	1275
BRISCOE E R E	100	69	1485
BROOKS L A	200	73	1531
BROWNING C E	600	73	1445
BRUNS E G	300	72	1524
BRUSEWITZ G H	600	72	1581
BUCHANAN R L	600	73	1385
BUCHER B L	200	72	1354
BUCKLEY J L	200	72	1266

BUTCHBAKER A F	100	73	1339
	200	72	1295
	200	72	1528
	600	72	1575
	600	72	1581
BUTLER R H	200	74	1527
CALLANTINE M R	100	61	1390
CALVERT C C	300	70	1388
CARDON D R	300	71	1598
CARLSON H C	100	68	1469
CARREKER J R	100	73	1450
CARROLL J J	300	74	1602
CASLER G L	300	72	1506
CHANG A C	600	73	1365
CHARLES D W	100	73	1315
CHERMS F L	100	68	1579
CHESNESS J L	600	74	1608
CHIU S Y	600	74	1568
CHRISTENSEN R L	600	73	1499
CHRISTENSON L R	100	73	1558
CLARK F E	100	72	1540
CLARK R N	200	73	1512
CLARKE N A	100	66	1344
CLAYBAUGH J W	400	70	1477
CLYMER B C	300	73	1471
COE W B	200	72	1355
COLEMAN EUGENE A	200	72	1296
COLYER D	200	72	1273
COM ON GOVERN OPERA	300	74	1606
CONNOR L J	200	72	1272
	200	73	1326
	300	73	1501
CONVERSE J C	200	73	1331
	200	73	1332
	700	66	1375
COOPER C	400	73	1607
COOPER H B H	200	74	1500
COSENZA B J	100	72	1516
COUCH J R	400	74	1563
CRAMER C O	200	73	1331
	200	73	1332
CRAUER L S	200	73	1336
CREGER C R	400	73	1492
CROPSEY M G	300	73	1474
CROSS F B	100	69	1461
CROSS O E	600	74	1604
CROWE R	200	72	1310
CROWLEY J W	300	72	1524
CRUZAN D C	100	71	1491
DALE A C	100	72	1541
DARFLER J M	100	73	1402
DAS K C	200	72	1278
DAUGHERTY R V	100	72	1555
DAWSON R N	100	73	1450
DAY D L	100	65	1573
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	600	73	1397
	600	73	1583
DAZZO F	100	73	1448
DECKER M JR	200	72	1278
DESHAZER J A	200	72	1442
DEWEY A W	100	72	1516
DOLL R J	200	72	1267
DORMINEY R W	600		1383
DORN D A	200	72	1289
DORNBUSH J N	300	73	1376
DRIGGERS L B	300		1546
	300	73	1517
DRUMMOND R G	100	73	1467
DUDZINSKI M L	100	73	1538
DUNBAR J R	300	74	1602
DUNN G G	200	72	1308
EDWARDS D M	100	72	1557
EDWARDS H M JR	400	60	1596
EDWARDS N L	100	73	1449
EDWARDS W M	100	72	1519
	200	72	1283
EFTINK B	400	73	1387
EGON S	600	73	1364
ELAM L	400	72	1439
ELLIOTT L F	100	71	1312
	100	72	1530
	100	72	1536
	100	73	1542
ELLIS B G	200	72	1297
ELLIS D	200	72	1304
ELLIS J R	200	72	1282
	300	72	1314
ELLIS L V	600	73	1463
ELSON H A	600	72	1595
ENGLAND C B	100	73	1556
ENGLER C R	300	73	1372
EPA	300	72	1576
	300	74	1346
ERICKSON A E	200	72	1297
ERICKSON D O	600	73	1385
ERICKSON L E	300	73	1372
ERNST S E	100	73	1467
ERSKINE F	200	71	1457

ESKINS K	200	72	1354
FAIRBANK W C	300	74	1601
FALTER J M	300		1546
	300	73	1517
FAN L T	300	73	1372
FARMER D M	300	73	1368
FARR F M	400	73	1492
FELDMANN H F	100	73	1343
FERGUSON T L	200	72	1275
FERNANDEZ R	100	73	1464
FISCHBACH P E	100	72	1557
FLEGAL C J	200	72	1289
FLEMING B	400	74	1610
FORDHAM H W	300	73	1367
FOSGATE O T	100	72	1553
FOX J U	100	73	1564
FRANZ M	100	71	1433
	400	71	1479
FRERE M H	100	72	1519
FULLER H L	400	60	1596
GAIRD J V	600	73	1594
GAJMERAC W L	400	72	1438
GARDNER F A	400	73	1492
GARNER W	200	72	1275
GARTON J E	100	73	1339
	200	72	1295
	600	72	1575
GELDREICH E E	100	66	1344
GEORGE R M	200	73	1330
	600	73	1445
	600	73	1463
GHELBACH A E	200	72	1285
GIDDENS J	300	73	1367
GILBERTSON C B	100	73	1424
	200	72	1282
	200	72	1302
	200	73	1332
	200	73	1413
	200	73	1421
	200	73	1422
	300	72	1314
	600	73	1589
GILLETTE A M	200	73	1333
GIVENS R L	300	73	1597
	300	74	1602
GOAN H C	400	73	1313
GODDARD W B	300	74	1602
GOLD R C	600	73	1609
	600	73	1609
GOLDSTEIN J	400	73	1481
GOLUEKE C G	100	72	1430
GOOD D L	300	73	1501
GOOD L D	700	71	1490
GOODRICH P R	600	74	1543
GOODRICH R D	400	73	1373
GOTTBRATH J	600	73	1605
GOWAN D	500	72	1539
GRAHAM D B	200	72	1268
GRANT D W	100	71	1423
GRAU C R	100	57	1507
GRAVES R E	400	74	1460
GRIFFIN M L	200	72	1354
GRIMM A	200	72	1276
GROSS C	400	71	1569
GRUB WALTER	200	72	1296
GUEST R W	200	73	1327
HAHN L	200	73	1325
HAIDER K	100	72	1540
HALL C F	300	73	1522
HALL T H	100	74	1493
HALLIGAN J E	200	73	1559
HAMILTIN H E	600	71	1554
HAMILTON H E	100	73	1564
HAMILTON P B	100	74	1525
HANKS H E	400	73	1373
HANSEN C M	200	72	1297
HANSEN E L	100	65	1573
HARMON B G	100	73	1437
HARMS R H	100	73	1495
HARPER L	400	71	1544
HARRIS G C JR	200	72	1441
HARTER D A	400	73	1489
HARWOOD D G	300	73	1517
	600	73	1594
HASHIMOTO A G	200	72	1311
HAZEN T E	200	72	1281
	200	72	1284
	200	73	1526
HEGG R O	200	72	1309
	600	73	1364
HELLICKSON M A	100	73	1381
HEMBRY F G	100	74	1472
HENDRICKSON D A	100	71	1423
HERMANSON R E	100	73	1582
HERR G	200	71	1404
HERZOG K L	200	73	1559
HESLER J C	200	72	1306
HICKS F W	200	71	1407
HILEMAN L H	300	72	1370
HILL M E	200	72	1300

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HOFFMAN B	200	73	1336
HOGLUND C R	200	72	1272
	300	73	1501
HOLMES L W J	700	71	1342
HOLT R F	100	73	1443
HORSFIELD B	600	73	1605
HORSLEY R W	100	73	1347
HOUKOM R L	600	72	1581
HOWE R M L	100	69	1426
HOWELLS D H	100	72	1570
HOWES J R	300	73	1522
HRUBANT G R	100	72	1555
HUBBELL D	100	73	1448
HUGH W	200	71	1455
HUISINGH D	200	72	1293
HULA M E	300	73	1368
HUMENIK F J	200	72	1293
HUMMEL J W	100	74	1494
	200	72	1277
	200	73	1337
HUSTED J V	200	74	1527
INGLETT G E	200	72	1352
	200	72	1354
INGLETT G E EDITOR	200	72	1351
JACKSON L G	200	73	1417
JACKSON S W	600	71	1554
JACOBS J J	300	72	1506
JAEGER G B	300	72	1603
JAKOBSON K	300	73	1551
JALEEL M A	700	72	1319
JAMES L G	600	74	1543
JENSEN A H	100	73	1437
JENSEN L S	400	73	1377
JOHANSON J B	600	73	1365
JOHNSON J B	200	72	1272
	200	73	1326
	300	73	1501
JOHNSON R R	300	72	1473
JONES B A JR	600	73	1583
JONES J R	300		1546
JONES P H	200	72	1305
JONES R W	200	72	1354
JORDAN H C	200	69	1580
KAULEC J	600	73	1605
KAPPE D S	200	72	1294
KARCZMARCZYK S	200	72	1300
KEELEY J W	300	73	1483
KEENE O D	200	71	1409
KEENEY D R	100	72	1435
KIANG K	100	73	1343
KIMBLE J M	100	72	1480
KING A W M	600	72	1595
KITTRIDGE C W	200	70	1321
KLAUSNER S D	200	72	1304
KLEIN N W	100	57	1507
KLETT R H	200	73	1511
KLOPFENSTEIN T	200	72	1356
KNIGHT D	400	73	1549
KOELLIKER J K	200	72	1284
KOERS W	200	72	1356
KOLEGA J J	100	72	1516
KOON J L	100	73	1582
KREHER H J	200	72	1291
KREIS R D	300	72	1396
	300	73	1368
KRIZ G J	100	72	1570
	300		1546
	300	73	1517
KRUEGER W F	300	73	1522
	600	73	1521
LACY W J	300	73	1551
LAFEVERS C J	300	73	1483
LARSON C L	600	74	1543
LARSON R D	200	72	1281
LARSON R E	200	72	1309
	600	73	1589
LAVEILLE W C	200	73	1338
LEHMAN O R	300	70	1447
LEIBHOLZ J	100	69	1518
LEMBKE W D	200	72	1399
LEONARD R L	100	72	1516
LEVI D R	200	72	1271
	200	72	1273
	600	71	1552
LIAO P B	100	70	1532
LINDLEY J A	700	70	1363
LITTLE J	300	73	1366
LOEHR R C	200	72	1311
LOEHR RAYMOND C	200	72	1298
LOFGREEN G P	300	73	1597
LONG T A	200	71	1408
LONGHOUSE A D	200	72	1279
LORENZEN R T	200	73	1327
LUCAS E	100	73	1464
LUDINGTON D C	200	72	1311
LUTZ J F	300		1546
LYNN H P	200	73	1329
MACMILLAN K	200	72	1303
MADDEN J M	300	73	1376
MADDEN J M	600	73	1589
MAHONEY G W A	100	73	1339
	200	72	1295
	600	72	1575
MANCHESTER A C	200	72	1353
MANGES H L	200	72	1301
MARRIOTT L F	200	72	1299
MARTIN G A	600	73	1594
MARTIN J H JR	200	72	1278
MARTIN K L	600	72	1560
MARTIN R D	300	70	1388
MATHERS A C	200	73	1510
	300	70	1447
	300	72	1561
MAYES H F	300	73	1468
MCCALLA T M	100	71	1312
	100	72	1530
	100	72	1536
	100	74	1535
	200	72	1282
	200	73	1415
	300	72	1314
MCCASKEY T A	300	73	1366
MCELROY A D	200	72	1275
	600	74	1568
MCGHEE T J	100	73	1391
	100	73	1558
MCGINNIS J	100	73	1464
MCGUFFEY K	100	72	1529
MCINTOSH J I	100	72	1480
MCINTOSH J L	100	72	1600
MCQUIGG J D	200	73	1325
MCQUITTY J B	300	72	1425
MEENAGHAN GEORGE F	200	72	1296
MEISKE J C	400	73	1373
MEYER J L	300	74	1601
MIDWEST PLAN SERVICE	300	72	1470
MIELKE L N	100	72	1530
	100	74	1535
MIELKI L N	100	73	1382
MILBERGER W	600	73	1521
MILLER B F	100	71	1588
MILLER G D	600	73	1384
MILLER R D	200	72	1359
MILNE R A	100	73	1444
MINER J R	200	72	1281
	200	72	1284
	200	72	1287
	200	73	1320
MOORE J A	600	73	1364
MORGAN N U	300	70	1388
MORRIS T B JR	600	73	1594
MORRISON S M	600	72	1560
MORRISON S R	300	73	1597
MOSIER A R	100	72	1540
	100	74	1400
MUIR F V	300	72	1603
MUIR J	100	73	1446
MULLIGAN T J	200	72	1306
MURPHY L S	200	72	1301
MYERS E A	200	74	1527
NAKAHARA J	200	71	1453
NATH K R	100	73	1402
NEB DEPT ENV CONTROL	200	73	1420
NELSON D	200	71	1456
NELSON G S	200	72	1441
NESHEIM M	200	72	1290
NIENABER J A	100	73	1424
	200	73	1413
NORDSTEDT R A	200	73	1328
NORTHERN W L	200	73	1329
NYE J C	200	73	1317
O ROURKE W	400	72	1380
OGILVIE J R	600	73	1394
OLIVER J C	300	74	1601
OLSON E A	200	73	1416
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OLSON R A	100	73	1446
OLSON W A	300	72	1599
ORTON W L	600	74	1567
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PAINE M	400	73	1475
	600	72	1575
PAINE M D	200	72	1295
	300	72	1395
	300	72	1440
PARKER H W	200	73	1559
PARKHURST C R	100	74	1525
PARKS B A	600		1584
PATEL J D	400	71	1487
PATEL R B	400	71	1487
PATNI N K	200	72	1305
PAYNE F A	100	73	1564
PEACH D	400	73	1520
PECK T R	200	72	1399
PERSON H L	200	72	1284
	200	72	1287
PETERS R E	200	73	1322
PETERSON M R	200	73	1330
PFEFFER J T	600	73	1583
PHILLIPS J A	600	73	1594
PHILLIPS R E	200	73	1330
PHILLIPS R L	200	72	1310
PITTMAN D J	100	73	1444
POLKOWSKI L B	200	71	1547
POOLE W H	600	74	1608
PORTER R M	200	73	1335
POS J	200	73	1334
POWERS W L	200	72	1301
PRATT G L	600	73	1385
PRES WATER POLL CONT	300	72	1576
PROPHET C W	100	73	1449
PURDUE UNIVERSITY	300	72	1503
QUISENBERRY J H	400	69	1523
RAO A M	300	73	1367
REDDELL D L	200	73	1322
	200	74	1500
	600	73	1614
REYNOLDS W L	100	74	1472
RHODES R A	100	72	1555
	600	74	1567
RIHLE J M	300	74	1601
RIEMANN U	200	72	1307
ROBBINS J W D	100	72	1570
ROBINSON J B	200	72	1308
ROEHRIG S	200	71	1458
ROKEBY T R C	200	72	1441
ROLL J L	600	73	1583
ROLLINS G H	300	73	1366
ROPER W E	100	68	1579
ROSS I J	100	73	1564
	600	71	1554
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100	71	1433	FISH-DIETS	PERPETUAL-MOTION RECYCLING OR PIG MANURE INTO FISH FOOD KEYWORDS RECYCLING FARM-WASTES
100	71	1433	FISH-FARMING	PERPETUAL-MOTION RECYCLING OR PIG MANURE INTO FISH FOOD KEYWORDS RECYCLING FARM-WASTES
100	69	1461	FISH-FAUNA	QUALITATIVE CHANGES IN THE FISH-FAUNA OF THE UPPER NEOSHO RIVER SYSTEM 1952-1967 KEYWO
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400	73	1549	REFEEDING	RECYCLING ANIMAL WASTES I THE PROBLEMS OF DISPOSAL AND REGULATORY ASPECTS OF RECYCLED M
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400	72	1578	SOILS	MANURE PROMOTED FOR CROPLAND KEYWORDS FARM-WASTES CROPS FERTILIZERS RATES-OF-APPLICAT
500	72	1539	SOILS	SLURRY AND FARM WASTE DISPOSAL KEYWORDS SLURRIES FARM-WASTES WASTE-DISPOSAL LEGAL-ASP
600	73	1394	SOILS	SOIL COLUMNS FOR SIMULATING ANIMAL MANURE RECYCLING KEYWORDS FARM-WASTES RECYCLING SOI
600	74	1636	SOILS	POLLUTIONAL ASPECTS AND CROP YIELDS RESULTING FROM HIGH MANURE APPLICATIONS ON SOIL KE
100	72	1430	SOIL	CHANGING FROM DUMPING TO RECYCLING PART 2 ORGANIC WASTES KEYWORDS RECYCLING ORGANIC-WA
600	73	1609	SOIL-ANALYSIS	DEVELOPMENT OF AN ORGANIC WASTE SLURRY INJECTOR KEYWORDS FARM-WASTES ORGANIC-WASTES WA
600	73	1609	SOIL-ANALYSIS	DEVELOPMENT OF AN ORGANIC WASTE SLURRY INJECTOR KEYWORDS FARM-WASTES ORGANIC-WASTES WA
100	71	1312	SOIL-CHEMICAL-PROP	USE OF CAISSONS FOR SAMPLING CHEMICAL AND BIOLOGICAL CONDITIONS BENEATH A BEEF FEEDLOT
200	72	1301	SOIL-CHEMICAL-PROP	EFFECTS OF SOLID BEEF FEEDLOT WASTES ON SOIL CONDITIONS AND PLANT GROWTH KEYWORDS FEE
200	72	1302	SOIL-CHEMICAL-PROP	GRASS RESPONSE TO APPLICATIONS OF BEEF-CATTLE FEEDLOT RUNOFF KEYWORDS FEED-LOTS AGRIC
600	73	1394	SOIL-COLUMNS	SOIL COLUMNS FOR SIMULATING ANIMAL MANURE RECYCLING KEYWORDS FARM-WASTES RECYCLING SOI
200	73	1513	SOIL-CONDITIONERS	FUTURE DEVELOPMENTS IN FEEDLOT WASTE MANAGEMENT KEYWORDS FEED-LOTS FARM-WASTES WATER-P
400	70	1488	SOIL-CONDITIONERS	NEW USES FOR POULTRY MANURE KEYWORDS POULTRY FARM-WASTES RECYCLING FEEDS FERTILIZERS
400	70	1478	SOIL-CONDITIONER	FARMS ARE NOT OUT IN THE COUNTRY ANY MORE KEYWORDS WASTE-DISPOSAL LIVESTOCK FARMS FAR
400	72	1578	SOIL-CONDITIONER	MANURE PROMOTED FOR CROPLAND KEYWORDS FARM-WASTES CROPS FERTILIZERS RATES-OF-APPLICAT
400	73	1481	SOIL-CONDITIONER	FERTILIZERS CROP QUALITY AND NUTRIENTS IN WASTES KEYWORDS FERTILIZERS CROPS NUTRIENTS
200	73	1510	SOIL-CONDITIONS	EFFECTS OF CATTLE FEEDLOT MANURE ON CROP YIELDS AND SOIL CONDITIONS KEYWORDS FEED-LOT
300	72	1561	SOIL-CONDITIONS	EFFECTS OF CATTLE FEEDLOT MANURE ON CROP YIELDS AND SOIL CONDITIONS KEYWORDS FARM-WAS
100	73	1443	SOIL-CONSERVATION	SURFACE WATER QUALITY IS INFLUENCED BY AGRICULTURAL PRACTICES KEYWORDS SURFACE-WATERS
200	72	1310	SOIL-CONSERVATION-	LAGOONS FOR MILKING CENTER WASTES KEYWORDS LAGOONS DAIRY-INDUSTRY FARM-WASTES WASTE-S
200	73	1419	SOIL-CONSERVATION-	RUNOFF CONTROL FOR A CREEK BANK FEEDLOT KEYWORDS LIVESTOCK FARM-WASTES WASTE-TREATMENT
200	73	1420	SOIL-CONSERVATION-	GUIDELINES ON LIVESTOCK WASTE CONTROL FACILITIES KEYWORDS LIVESTOCK FARM-WASTES WASTE
100	61	1390	SOIL-CONTAMINATION	FECAL ELIMINATION OF ESTROGENS BY CATTLE TREATED WITH DIETHYLSTILBESTROL AND HEXESTROL
100	71	1312	SOIL-CONTAMINATION	USE OF CAISSONS FOR SAMPLING CHEMICAL AND BIOLOGICAL CONDITIONS BENEATH A BEEF FEEDLOT
100	72	1557	SOIL-CONTAMINATION	MOVEMENT OF NITRATES UNDER IRRIGATED AGRICULTURE KEYWORDS NITRATES IRRIGATION GROUNDW
100	73	1443	SOIL-CONTAMINATION	SURFACE WATER QUALITY IS INFLUENCED BY AGRICULTURAL PRACTICES KEYWORDS SURFACE-WATERS
100	73	1444	SOIL-CONTAMINATION	EFFECT OF FEEDLOT MANURE ON SOIL AND WATER QUALITY KEYWORDS FEED-LOTS FARM-WASTE SOIL
100	73	1448	SOIL-CONTAMINATION	THE INFLUENCE OF MANURE SLURRY IRRIGATION ON THE SURVIVAL OF FECAL ORGANISMS IN SCRANTO
100	74	1535	SOIL-CONTAMINATION	SOIL PROFILE CONDITIONS OF CATTLE FEEDLOTS KEYWORDS SOIL-PROFILE FEED-LOTS CATTLE FARM
200	72	1266	SOIL-CONTAMINATION	AGRICULTURE IN THE ENVIRONMENT KEYWORDS AGRICULTURE ENVIRONMENT FARM-WASTES AIR-POLLU
200	72	1297	SOIL-CONTAMINATION	INITIAL OBSERVATIONS OF SEVERAL MEDIUM SIZED BARRIERED LANDSCAPE WATER RENOVATION SYSTE
200	72	1351	SOIL-CONTAMINATION	SYMPOSIUM-PROCESSING AGRICULTURAL AND MUNICIPAL WASTES KEYWORDS RESEARCH-AND-DEVELOPME
300	73	1517	SOIL-CONTAMINATION	POULTRY WASTE MANAGEMENT ALTERNATIVES KEYWORDS POULTRY FARM-WASTES WASTE-TREATMENT WA
400	72	1578	SOIL-CONTAMINATION	MANURE PROMOTED FOR CROPLAND KEYWORDS FARM-WASTES CROPS FERTILIZERS RATES-OF-APPLICAT
300	73	1366	SOIL-DISPOSAL-FIEL	WATER POLLUTION BY DAIRY FARM WASTES AS RELATED TO METHOD OF WASTE DISPOSAL KEYWORDS
100	71	1312	SOIL-GASES	USE OF CAISSONS FOR SAMPLING CHEMICAL AND BIOLOGICAL CONDITIONS BENEATH A BEEF FEEDLOT
200	72	1285	SOIL-INJECTION	OPERATIONAL PROBLEMS OF PORK PRODUCTION RELATED TO ENVIRONMENTAL QUALITY KEYWORDS HOG
200	72	1291	SOIL-INJECTION	OPERATIONAL PROBLEMS OF POULTRY PRODUCTION RELATED TO ENVIRONMENTAL QUALITY KEYWORDS
200	73	1333	SOIL-INJECTION	AGITATING PUMPING AND INJECTING LIQUID MANURE KEYWORDS WASTE-DISPOSAL LIQUID-WASTES FA
300	73	1501	SOIL-INJECTION	ECONOMIC IMPACTS OF APPLYING SELECTED POLLUTION CONTROL MEASURES ON MICHIGAN DAIRY FARM
200	72	1304	SOIL-LOSS-ORTHOPHO	SURFACE RUNOFF NUTRIENT LOSSES FROM VARIOUS LAND DISPOSAL SYSTEMS FOR DAIRY MANURE KEY
200	72	1281	SOIL-MANURE-PELLET	STORAGE OF MANURE SOLIDS BY FORMING SOIL-MANURE PELLETS KEYWORDS HYDRAULIC-TRANSPORTA
200	72	1303	SOIL-NITROGEN-TRAN	A STUDY OF CORN RESPONSE AND SOIL NITROGEN TRANSFORMATIONS UPON APPLICATION OF DIFFERE
200	73	1330	SOIL-PLANT-FILTER	IRRIGATION DISPOSAL OF MILKING CENTER WASTES KEYWORDS IRRIGATION WASTE-TREATMENT WASTE
100	72	1480	SOIL-PROFILES	FATE OF NITRATE FROM MANURE AND INORGANIC NITROGEN IN A CLAY SOIL CROPPED TO CONTINUOUS
100	72	1530	SOIL-PROFILES	AMMONIUM NITRATE AND TOTAL NITROGEN IN THE SOIL WATER OF FEEDLOT AND FIELD SOIL PROFILE
100	72	1536	SOIL-PROFILES	THE COMPOSITION OF THE SOIL ATMOSPHERE BENEATH A BEEF CATTLE FEEDLOT AND A CROPPED FIEL
100	72	1557	SOIL-PROFILES	MOVEMENT OF NITRATES UNDER IRRIGATED AGRICULTURE KEYWORDS NITRATES IRRIGATION GROUNDW
100	73	1556	SOIL-PROFILES	RELATIVE LEACHING POTENTIALS ESTIMATED FROM HYDROLOGIC SOIL GROUPS KEYWORDS LEACHING
200	72	1302	SOIL-PROFILES	GRASS RESPONSE TO APPLICATIONS OF BEEF-CATTLE FEEDLOT RUNOFF KEYWORDS FEED-LOTS AGRIC
400	71	1486	SOIL-PROFILES	REDUCING FEEDLOT NITRATES IN YOUR GROUND WATER KEYWORDS NITRATES FEED-LOTS GROUNDWATER
100	72	1540	SOIL-PROFILE	WATER SOLUBLE ORGANIC SUBSTANCES LEACHABLE FROM FEEDLOT MANURE KEYWORDS FEEDLOTS FARM
100	74	1535	SOIL-PROFILE	SOIL PROFILE CONDITIONS OF CATTLE FEEDLOTS KEYWORDS SOIL-PROFILE FEED-LOTS CATTLE FARM
200	72	1282	SOIL-PROFILE	CHEMICAL STUDIES OF SOLIDS RUNOFF SOIL PROFILE AND GROUNDWATER FROM BEEF CATTLE FEEDLOT
200	73	1510	SOIL-PROFILE	EFFECTS OF CATTLE FEEDLOT MANURE ON CROP YIELDS AND SOIL CONDITIONS KEYWORDS FEED-LOT
200	73	1328	SOIL-TYPES	LAGOON DISPOSAL OF DAIRY WASTES IN FLORIDA KEYWORDS LAGOONS FARM-WASTES WASTE-DISPOSAL

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100	72	1530	SOIL-WATER	AMMONIUM NITRATE AND TOTAL NITROGEN IN THE SOIL WATER OF FEEDLOT AND FIELD SOIL PROFILE
300	70	1447	SOIL-WATER	SEEPAGE OF FEEDYARD RUNOFF WATER IMPOUNDED IN PLAYAS KEYWORDS AGRICULTURAL-RUNOFF SEEP
300	73	1362	SOIL-WATER	POULTRY MANURE DISPOSAL BY PLOW FURROW COVER KEYWORDS AGRICULTURAL-MACHINERY DEPOSITIO
100	73	1424	SOLIDS	BEEF CATTLE FEEDLOT RUNOFF-PHYSICAL PROPERTIES KEYWORDS AGRICULTURAL-RUNOFF FEED-LOTS
300	73	1376	SOLIDS	POLLUTION POTENTIAL OF RUNOFF FROM PRODUCTION LIVESTOCK FEEDING OPERATIONS IN SOUTH DAK
200	72	1309	SOLIDS-BALANCE	SOLIDS BALANCE ON A BEEF CATTLE OXIDATION DITCH KEYWORDS FARM-WASTES CATTLE OXIDATION-
100	72	1541	SOLIDS-LIQUID-SEPA	SOLIDS LIQUID SEPARATION AN IMPORTANT STEP IN THE RECYCLING OF DAIRY COW WASTES KEYWOR
100	73	1382	SOLIDS-TRAP	SOLIDS TRAP FOR BEEF CATTLE FEEDLOT RUNOFF KEYWORDS CATTLE FEED-LOTS AGRICULTURAL-RUN
200	72	1441	SOLID-STATE-CONTRO	SOLID STATE CONTROLS FOR ENVIRONMENTAL CHAMBERS KEYWORDS POULTRY PERFORMANCE ENVIRONME
600	74	1567	SOLID-SUBSTRATE-FE	SOLID SUBSTRATE FERMENTATION OF FEEDLOT WASTE COMBINED WITH FEED GRAINS KEYWORDS FARM
100	69	1426	SOLID-WASTES	INDUSTRIAL WASTES-RESEARCH AND PRACTICE IN ANIMAL WASTES TREATMENT KEYWORDS FARM-WAST
100	73	1340	SOLID-WASTES	FEEDLOT WASTE MANAGEMENT-PROGRESS AND OUTLOOK KEYWORDS WASTE-DISPOSAL WASTE-TREATMENT
100	73	1340	SOLID-WASTES	FEEDLOT WASTE MANAGEMENT-PROGRESS AND OUTLOOK KEYWORDS WASTE-DISPOSAL WASTE-TREATMENT
100	73	1343	SOLID-WASTES	CATTLE MANURE TO PIPELINE GAS KEYWORDS CATTLE FARM-WASTES RECYCLING SOLID-WASTES ORGA
100	73	1382	SOLID-WASTES	SOLIDS TRAP FOR BEEF CATTLE FEEDLOT RUNOFF KEYWORDS CATTLE FEED-LOTS AGRICULTURAL-RUN
200	72	1282	SOLID-WASTES	CHEMICAL STUDIES OF SOLIDS RUNOFF SOIL PROFILE AND GROUNDWATER FROM BEEF CATTLE FEEDLOT
200	72	1295	SOLID-WASTES	EVALUATION OF BEEF WASTE MANAGEMENT ALTERNATIVES KEYWORDS CATTLE FARM-WASTES WASTE-TR
200	73	1331	SOLID-WASTES	SOLID MANURE HANDLING FOR DAIRY CATTLE KEYWORDS DAIRY-INDUSTRY CATTLE SOLID-WASTES LI
200	73	1412	SOLID-WASTES	HYDROLOGIC AND HYDRAULIC CONSIDERATIONS FOR DESIGN OF LIVESTOCK WASTE MANAGEMENT SYSTEM
200	73	1413	SOLID-WASTES	FEEDLOT RUNOFF CONTROL SYSTEM DESIGN AND INSTALLATION A CASE STUDY KEYWORDS AGRICULTU
200	73	1417	SOLID-WASTES	LIVESTOCK WASTE MANAGEMENT SYSTEMS-MANAGEMENT AND MAINTENANCE DESIGN CONSIDERATIONS KE
300	72	1395	SOLID-WASTES	BEEF CATTLE FEEDLOT SITE SELECTION FOR ENVIRONMENTAL PROTECTION KEYWORDS FEED-LOTS SI
300	72	1503	SOLID-WASTES	WASTE HANDLING AND DISPOSAL GUIDELINES FOR INDIANA BEEF PRODUCERS KEYWORDS WASTE-DISP
300	72	1524	SOLID-WASTES	SOLID MANURE HANDLING FOR LIVESTOCK HOUSING FEEDING AND YARD FACILITIES IN WISCONSIN KE
300	73	1368	SOLID-WASTES	ENVIRONMENT PROTECTION CONCEPTS OF BEEF CATTLE FEEDLOT WASTES MANAGEMENT KEYWORDS FEE
400	73	1374	SOLID-WASTES	A FEEDLOT WITHOUT WASTE KEYWORDS FEED-LOTS FARM-WASTES CATTLE CONFINEMENT-PENS RECYCL
400	73	1379	SOLID-WASTES	SOLID WASTE MANAGEMENT ALTERNATIVES KEYWORDS SOLID-WASTES FARM-WASTES FEED-LOTS WASTE
400	74	1562	SOLID-WASTES	REFEEDING FEED KEYWORDS RECYCLING FARM-WASTES FEEDS CATTLE FEED-LOTS POULTRY WASTE-DI
600	72	1575	SOLID-WASTES	EFFECT OF FEEDLOT LAWS AND CLIMATE ON OPEN FEEDLOT WASTE MANAGEMENT KEYWORDS FEED-LOT
600	73	1364	SOLID-WASTES	SETTLING SOLIDS IN ANIMAL WASTE SLURRIES KEYWORDS FARM-WASTES SLURRIES SEDIMENTATION
300	73	1362	SOLID-WASTE-DISPOS	POULTRY MANURE DISPOSAL BY PLOW FURROW COVER KEYWORDS AGRICULTURAL-MACHINERY DEPOSITIO
300	73	1522	SOLID-WASTE-DISPOS	THE EFFECT OF PROCESSING POULTRY MANURE ON DISEASE AGENTS KEYWORDS POULTRY DISEASES FA
100	73	1444	SOLUBLE-SALTS	EFFECT OF FEEDLOT MANURE ON SOIL AND WATER QUALITY KEYWORDS FEED-LOTS FARM-WASTE SOIL
100	72	1435	SOURCES	AVAILABLE NITROGEN IN RURAL ECOSYSTEMS SOURCES AND FATE KEYWORDS NITROGEN ECOSYSTEMS S
300	72	1571	SOURCES	ENERGY POTENTIAL FROM ORGANIC WASTES A REVIEW OF THE QUANTITIES AND SOURCES KEYWORDS
100	73	1574	SOUTHEAST-U-S	THE EFFECTS ON RUNOFF GROUNDWATER AND LAND OF IRRIGATING WITH CATTLE MANURE SLURRIES K
200	72	1276	SOUTHERN-CALIFORNI	DAIRY MANURE WASTE HANDLING SYSTEMS KEYWORDS DAIRY-INDUSTRY WASTE-DISPOSAL WASTE-TREA
100	73	1453	SOUTHERN-PIEDMONT	USING POULTRY LITTER IRRIGATION AND TALL FESCUE FOR NOTILL CORN PRODUCTION KEYWORDS
100	73	1587	SOUTHWEST-U-S	SLATS IN THE SOUTHWEST KEYWORDS CONFINEMENT-PENS PERFORMANCE CATTLE COSTS LAGOONS SPR
200	72	1296	SOUTHWEST-U-S	CHARACTERISTICS OF WASTES FROM SOUTHWEST BEEF CATTLE FEEDLOTS KEYWORDS FEED-LOTS FARM
400	73	1467	SOUTH-AFRICA	MANURE POWER AN OVERLOOKED ENERGY SOURCE KEYWORDS ENERGY FARM-WASTES METHANE WASTE-T
600	73	1378	SOUTH-CAROLINA	THE BUILDING OF A FEEDLOT KEYWORDS FEED-LOTS FARM-WASTES CATTLE WASTE-DISPOSAL DAIRY
300	73	1483	SOUTH-CENTRAL-UNIT	GROUND WATER POLLUTION IN THE SOUTH CENTRAL STATES KEYWORDS GROUND-WATER WATER-POLLUTI
300	73	1376	SOUTH-DAKOTA	POLLUTION POTENTIAL OF RUNOFF FROM PRODUCTION LIVESTOCK FEEDING OPERATIONS IN SOUTH DAK
600	73	1498	SOUTH-DAKOTA	MENACING RUNOFF CONTROLLED WITH LAGOON SYSTEM KEYWORDS AGRICULTURAL-RUNOFF WATER-POLLU
300	73	1597	SPACE	SPRINKLING CATTLE FOR CONTROL OF HEAT STRESS KEYWORDS SPRINKLING CATTLE CONTROL HEAT
300	72	1396	SPATIAL-REQUIREMEN	BEEF CATTLE FEEDLOT SITE SELECTION FOR ENVIRONMENTAL PROTECTION KEYWORDS FEED-LOTS SI
100	73	1449	SPECIES-DIVERSITY	BENTHIC MACROINVERTEBRATE COMMUNITY STRUCTURE IN A GREAT PLAINS STREAM RECEIVING FEEDLO
300	72	1524	SPECIFICATIONS	SOLID MANURE HANDLING FOR LIVESTOCK HOUSING FEEDING AND YARD FACILITIES IN WISCONSIN KE
600	72	1581	SPECIFIC-HEAT	THERMAL PROPERTIES OF BEEF MANURE KEYWORDS THERMAL-CONDUCTIVITY FARM-WASTES CATTLE SP
400	73	1379	SPREADER-TRUCK	SOLID WASTE MANAGEMENT ALTERNATIVES KEYWORDS SOLID-WASTES FARM-WASTES FEED-LOTS WASTE
400	72	1434	SPREADING	ENERGY NEEDED TO MANAGE ANIMAL WASTE KEYWORDS ENERGY FARM-WASTES MANAGEMENT RECYCLING
400	72	1484	SPREADING	FERTILITY KEYWORDS FERTILITY FERTILIZERS WASTE-DISPOSAL ECONOMICS CATTLE WASTE-STORAG
400	73	1393	SPREADING	REDUCING LABOR DURING BROILER GROWOUT KEYWORDS AUTOMATION LITTER FARM-WASTES LABOR CL
200	73	1414	SPRINKLER-APPLICAT	SPRINKLER APPLICATION OF LIQUID WASTES FROM HOLDING PONDS KEYWORDS WASTE-DISPOSAL LIQU
100	73	1448	SPRINKLER-IRRIGATI	THE INFLUENCE OF MANURE SLURRY IRRIGATION ON THE SURVIVAL OF FECAL ORGANISMS IN SCRANTO
100	73	1587	SPRINKLING	SLATS IN THE SOUTHWEST KEYWORDS CONFINEMENT-PENS PERFORMANCE CATTLE COSTS LAGOONS SPR
300	73	1471	SPRINKLING	CONTROL OF FLIES AROUND FEEDLOTS KEYWORDS FEED-LOTS FARM-WASTES LARVICIDES CHEMCONTRO
300	73	1597	SPRINKLING	SPRINKLING CATTLE FOR CONTROL OF HEAT STRESS KEYWORDS SPRINKLING CATTLE CONTROL HEAT
300	74	1602	SPRINKLING	SPRINKLING FOR DUST SUPPRESSION IN A CATTLE FEEDLOT KEYWORDS SPRINKLING DUSTS FEED-LO
100	70	1436	STABILIZATION	ELECTRICAL METHODS OF TREATING FARM EFFLUENT SHOULD CUT COSTS KEYWORDS WASTE-TREATMEN
100	72	1430	STABILIZATION	CHANGING FROM DUMPING TO RECYCLING PART 2 ORGANIC WASTES KEYWORDS RECYCLING ORGANIC-WA
100	73	1508	STABILIZATION	BRIDGETON N J SLUDGE COMPOSTING PROJECT A CITY FARM RELATIONSHIP KEYWORDS HOGS FARM-W
200	73	1323	STALL-BARNS	DAIRY HOUSING NATIONAL DAIRY HOUSING CONFERENCE KEYWORDS DAIRY-INDUSTRY FARM-WASTES WA
200	73	1324	STALL-BARNS	CONVENTIONAL STALL BARNS WITH GUTTER GRATES AND LIQUID MANURE STORAGE KEYWORDS WASTE-
300	74	1346	STALL-BARN	FEEDLOTS POINT SOURCE CATEGORY EFFLUENT GUIDELINES AND STANDARDS PART II KEYWORDS FEE
600	73	1499	STANCHION-DAIRY-OP	ECONOMIC COSTS OF WATER QUALITY PROTECTION ON DAIRY FARMS KEYWORDS COSTS ECONOMICS DAI
300	73	1501	STANCHION-HOUSING	ECONOMIC IMPACTS OF APPLYING SELECTED POLLUTION CONTROL MEASURES ON MICHIGAN DAIRY FARM
300	74	1346	STANDARDS	FEEDLOTS POINT SOURCE CATEGORY EFFLUENT GUIDELINES AND STANDARDS PART II KEYWORDS FEE
200	73	1326	STATE-POLLUTION-CO	POTENTIAL ECONOMIC IMPACTS OF STATE POLLUTION CONTROL ON DAIRY FARMS KEYWORDS ECONOMI
200	73	1326	STATE-STATUTES	POTENTIAL ECONOMIC IMPACTS OF STATE POLLUTION CONTROL ON DAIRY FARMS KEYWORDS ECONOMI
200	71	1547	STEAM-DISTILLATION	IDENTIFYING ODOROUS COMPONENTS OF STORED DAIRY MANURE KEYWORDS ODOR FARM-WASTES WASTE-
100	73	1564	STERILIZATION	SHORT TIME HIGH TEMPERATURE EXTRUSION OF CHICKEN EXCRETA KEYWORDS POULTRY TEMPERATURE
400	73	1374	STERILIZATION	A FEEDLOT WITHOUT WASTE KEYWORDS FEED-LOTS FARM-WASTES CATTLE CONFINEMENT-PENS RECYCL
200	73	1512	STOCKING	AMOUNTS COMPOSITION AND MANAGEMENT OF FEEDLOT RUNOFF KEYWORDS RUNOFF FEED-LOTS CHEMICA
200	73	1328	STORAGE-POND	LAGOON DISPOSAL OF DAIRY WASTES IN FLORIDA KEYWORDS LAGOONS FARM-WASTES WASTE-DISPOSAL
600	72	1575	STORMS	EFFECT OF FEEDLOT LAWS AND CLIMATE ON OPEN FEEDLOT WASTE MANAGEMENT KEYWORDS FEED-LOT
600	72	1575	STORM-RAINFALL	EFFECT OF FEEDLOT LAWS AND CLIMATE ON OPEN FEEDLOT WASTE MANAGEMENT KEYWORDS FEED-LOT
600	73	1614	STORM-RUNOFF	WATER QUALITY OF STORM RUNOFF FROM A TEXAS BEEF FEEDLOT KEYWORDS WATER-QUALITY STORM-R
100	73	1446	STREAMFLOW	A STUDY OF FACTORS INFLUENCING THE NITROGEN AND PHOSPHORUS CONTENTS OF NEBRASKA WATERS
100	72	1570	STREAMS	STREAM POLLUTION FROM ANIMAL PRODUCTION UNITS KEYWORDS WATER-POLLUTION STREAMS FEED-LO
100	66	1344	STREPTOCOCCI	BACTERIAL POLLUTION INDICATORS IN THE INTESTINAL TRACT OF FRESHWATER FISH KEYWORDS BA
100	68	1469	STRESS	COLIFORM BACTERIA IN CHICKEN BROILER HOUSE DUST AND THEIR POSSIBLE RELATIONSHIP TO COLI
300	72	1576	STRIP-MINES	THE RELATIONSHIP BETWEEN ANIMAL WASTES AND WATER QUALITY KEYWORDS FARM-WASTES WATER-QU
300	74	1601	SUBFLOOR	SUBFLOOR MONITORING OF SHADY GROVE DAIRY LIQUID MANURE HOLDING POND KEYWORDS MONITORI
300	73	1501	SUBSURFACE-DISPOSA	ECONOMIC IMPACTS OF APPLYING SELECTED POLLUTION CONTROL MEASURES ON MICHIGAN DAIRY FARM
400	70	1478	SUBURBAN-AREAS	FARMS ARE NOT OUT IN THE COUNTRY ANY MORE KEYWORDS WASTE-DISPOSAL LIVESTOCK FARMS FAR
300	71	1598	SUB-SURFACE-DRAINA	POSSIBILITY OF REDUCING NITROGEN IN DRAINAGE WATER BY ON FARM PRACTICES KEYWORDS NITR
200	72	1299	SUCTION-LYSIMETERS	CONTRIBUTION OF ANIMAL WASTE TO NITRATE NITROGEN IN SOIL KEYWORDS FARM-WASTES WASTE-DI
300	73	1362	SUCTION-LYSIMETERS	POULTRY MANURE DISPOSAL BY PLOW FURROW COVER KEYWORDS AGRICULTURAL-MACHINERY DEPOSITIO
100	72	1427	SULFUR	THE SOCIAL REDEMPTION OF PURE GARBAGE KEYWORDS RECLAMATION WASTES CALIFORNIA ANAEROBI
400	74	1432	SULFUR	COMPOSTED MANURE CALLED AVAILABLE FUEL SOURCE KEYWORDS FARM-WASTES FUELS RECYCLING WAS
200	73	1325	SUMMER-ENVIRONMENT	SUMMER ENVIRONMENTAL MODIFICATION SYSTEMS FOR DAIRY COW HOUSING IN THE UNITED STATES K
200	71	1547	SUPERNATANT	IDENTIFYING ODOROUS COMPONENTS OF STORED DAIRY MANURE KEYWORDS ODOR FARM-WASTES WASTE-
200	71	1457	SUPER-FARM	HAWAII ISLAND OF HOPE FOR PORK INDUSTRY KEYWORDS HAWAII HOGS AUTOMATION PORK-INDUSTRY
400	71	1544	SUPREME-COURT	SUPREME COURT UPHOLDS JUDGEMENTS IN HBI CASE KEYWORDS AIR-POLLUTION LEGAL-ASPECTS COUR
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200	72	1305	SUSPENDED-SOLIDS	A STUDY OF FOAMING PROBLEMS IN AN OXIDATION DITCH TREATING SWINE WASTE KEYWORDS FARM
200	73	1320	SUSPENDED-SOLIDS	A ROTATING FLIGHTED CYLINDER TO SEPARATE MANURE SOLIDS FROM WATER KEYWORDS FARM-WASTE
600	73	1364	SUSPENDED-SOLIDS	SETTLING SOLIDS IN ANIMAL WASTE SLURRIES KEYWORDS FARM-WASTES SLURRIES SEDIMENTATION
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300	73	1483	WATER-RESOURCES	GROUND WATER POLLUTION IN THE SOUTH CENTRAL STATES KEYWORDS GROUND-WATER WATER-POLLUTI
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100	73	1574	WATER-REUSE	THE EFFECTS ON RUNOFF GROUNDWATER AND LAND OF IRRIGATING WITH CATTLE MANURE SLURRIES K

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400 74 1371  WEATHER            FEEDERS IGNORE POLLUTION RULES-RISK STIFF FINES  KEYWORDS FEED-LOTS REGULATION FINES PE
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C. Characteristics of Animal Wastes	1. General 2. Physical 3. Chemical 4. Biological 5. Management's Impact On
D. Treatment Processes	1. General 2. Physical 3. Chemical 4. Biological
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SECTION VII

ABSTRACTS

1265 - B1, E4

WASTE MANAGEMENT RESEARCH, PROCEEDINGS OF THE 1972 CORNELL AGRICULTURAL WASTE MANAGEMENT CONFERENCE

Waste Management Research, Proceedings of the 1972 Cornell Agricultural Waste Management Conference, Ithaca, New York, 380 p. 160 fig. 151 tab, 265 ref.

Descriptors: Farm wastes, *Waste disposal *Agriculture, *Environment, *Pollutants, *Waste treatment, *Waste storage, *Legal aspects, *Regulations, *Cattle, *Feed lots, Poultry, Hogs, Agricultural runoff, Recycling, Pollution abatement. Identifiers: *Waste management, Composting, Refeeding wastes, Pyrolysis.

Forty-nine papers were presented at the Cornell Waste Management Conference. These papers present varied aspects of waste management including: (1) legal and legislative regulations, (2) problems and alternatives for handling, treatment, and disposal systems for dairy, hog, beef, and poultry waste, (3) water quality, and (4) utilization of wastes as a feed source. (Marquard-East Central).

1266 - A1, E3, F4

AGRICULTURE IN THE ENVIRONMENT

Environmental Protection Agency.
J. L. Buckley
Waste Management Research, Proceedings of the 1972 Cornell Agricultural Waste Management Conference, Ithaca, New York, p. 1-7.

Descriptors: *Agriculture, *Environment, *Farm wastes, *Air pollution, *Water pollution, *Soil contamination, Industrial wastes, Municipal wastes, Feed lots, Research and development. Idenitfiers: *Environmental Protection Agency, National Environmental Research Centers.

This lead symposium paper for the Cornell Agricultural Waste Management Conference called for two basic accomplishments: (1) to find ways to halt agricultural pollution, and (2) to find uses for agricultural wastes. Agricultural pollution was defined and the EPA's role in eliminating it was discussed. (Lynch-East Central).

1267 - A3, F1, F2, F3

ECONOMIC IMPACT OF AGRICULTURAL POLLUTION CONTROL PROGRAMS

Federal Reserve Bank of Kansas City.
R. J. Doll
Waste Management Research, Proceedings of the 1972 Cornell Agricultural Waste Management Conference, Ithaca, New York, p. 9-16, 3 tab, 3 append.

Descriptors: *Agriculture, *Technology, *Management, *Economic impact, *Control, *Regulation, Agricultural runoff, Kansas, Feed lots. Identifiers: *Agribusiness, Tenth Federal Reserve District.

Flexible regulatory systems governed by enlightened administrations are needed to replace existing uniform pollution control programs for agriculture. These systems should be viable and flexible enough to adequately control the environment without unduly restricting economic growth. An example is pollution caused by runoff of nitrogen-based fertilizers and other chemicals. Such runoff must be brought under control. The real problem is how to minimize such pollution, but, at the same time, permit the efficiencies achieved by technology. The proposal that the amount of a given chemical used per acre should be limited seems an incorrect approach because of the influence of such variables as soil type, climate, topography, method and time of application, and soil preparation tactics. (Lynch-East Central).

1268 - B1, F1, F4

PUBLIC RELATIONS ASPECTS OF AGRICULTURAL WASTE MANAGEMENT

Graham Farms.
D. B. Graham
Waste Management Research, Proceedings of the 1972 Cornell Agricultural Waste Management Conference, Ithaca, New York, p. 17-24.

Descriptors: *Farm wastes, *Waste treatment, *Recycling, Pollution abatement, Odor, Waste disposal. Identifiers: *Public relations, *Agricultural Waste Management.

An overview of animal waste management methods and economic implications is presented to show that the public must be informed about the farmer's pollution problems and solutions. There is a need for public acceptance of farm wastes as a valuable recyclable resource. (Lynch-East Central).

1269 - A2, B1, E1, F2

IMPLICATIONS OF THE PERMIT PROGRAM IN THE POULTRY AND ANIMAL FEEDING INDUSTRY

Office of Research and Monitoring, Environmental Protection Agency.
D. F. Anderson
Waste Management Research, Proceedings of the 1972 Cornell Agricultural Waste Management Conference, Ithaca, New York, p. 25-45. 8 fig, 9 tab, 35 ref.

Descriptors: *Waste disposal, *Water pollution treatment, *Water permits *Feed lots, *Agricultural runoff, *Waste treatment, Water pollution, Water law, Waste water disposal, Livestock, Biochemical oxygen demand, Chemical oxygen demand, Poultry. Identifiers: *Pollution discharge, Executive Order Number 11574, Zero discharge.

Now in suspension, Executive Order Number 11574 called for the U. S. Army Corps of Engineers to assume responsibility for issuing permits for all industrial pollution discharges into navigable streams and their tributaries. Permits for agricultural discharges into waterways were to apply to operations of 1000 animal waste units and larger with violators subject to fines and/or injunction. The proposed national goal was 'zero discharge" by 1985. New methods of meeting discharge requirements such as sedimentation, lagooning, and recycling were proposed. Pollutant concentrations in runoff and water discharge as well as methods of disposing of animal wastes are cited. (Lynch-East Central).

1270 - F2

APPLICATION OF IOWA'S WATER POLLUTION CONTROL LAW TO LIVESTOCK OPERATIONS

Iowa State Department of Health.
U. Agena
Waste Management Research, Proceedings of the 1972 Cornell Agricultural Waste Management Conference, Ithaca, New York, p. 47-59.

Descriptors: *Regulation, *Water law, *Water permits *Water pollution control, *Farm wastes, *Livestock, *Feedlots, *Iowa, *Waste disposal, Waste treatment, Inspection, Poultry, Runoff. Identifiers: *Permit requirements, *Iowa Water Pollution Control Law, Rural Environmental Assistance Program (REAP), Water discharge.

In conjunction with the Agricultural Stabilization Conservation Service, the Soil Conservation Service, and the Cooperative Extension Service, the Iowa Water Pollution Control Commission became responsible for prevention, control, and abatement of water pollution in that state in 1965. The commission registers feedlots, evaluates feedlots for pollution potential, and issues permits for waste disposal. Requirements for feedlot registration and regulation based on the number of confined animals and the destination of the runoff water are defined and outlined. (Lynch-East Central).

1271 - B1, F2

A REVIEW OF PUBLIC AND PRIVATE LIVESTOCK WASTE REGULATIONS

Missouri University, Columbia.
D. R. Levi
Waste Management Research, Proceedings of the 1972 Cornell Agricultural Waste Management Conference, Ithaca, New York. p. 61-69.

Descriptors: *Regulation, *Farm wastes, *Livestock, *Feed lots, *Zoning, *Civil law, Permits, Water pollution, Legal aspects, Contracts, Air pollution, Waste disposal, Pollution abatement. Identifiers: *Public regulation, *Private regulation, Licensing law, Injunctions, Site selection.

All states now have very similar public regulatory agencies which control pollution by adhering to precise tolerance mandates. When tolerance levels are exceeded, the board may seek an injunction, assess daily fines, institute a lawsuit to recover damages or issue tax bills for construction of adequate pollution control facilities. Private regulation, uncertain and unpredictable due to dependence on a jury, occurs indirectly in civil lawsuits through the nuisance laws. Under these laws a plaintiff may sue for injunction, damages, or both. Feedlot operators were advised to consider zoning, site selection, and prior occupation in setting up new operations. (Lynch-East Central).

1272 - F1, F2

IMPLICATIONS OF STATE ENVIRONMENTAL LEGISLATION ON LIVESTOCK WASTE MANAGEMENT

U. S. Department of Agriculture, Michigan State University.
J. B. Johnson, L. J. Connor, C. R. Hoglund, and J. R. Black.
Waste Management Research, Proceedings of the 1972 Cornell Agricultural Waste Management Conference, Ithaca, New York, p. 71-81. 4 tab, 7 ref.

Descriptors: *Economic efficiency, *Legislation, *Environment, *Livestock, Pollution abatement, Permits Control, Confinement pens. Identifiers: *Waste management, Administrative codes, Legislative proposals, Registration critera.

A 1971 survey of statutes in 27 major beef-producing states revealed a mixture of general statutes, specific registry statutes, administrative codes, approval procedures, and permit systems. Tables show percentages of beef produced in the states surveyed, the forms of state water pollution statutes applicable to livestock waste management, critera for registration requirements of livestock and poultry production firms, and critera for registration requirements of permits provided by general state water quality statutes. Implications of these statutes for both beef producers and society were broadly discussed. (Lynch-East Central).

1273 - B1, F2

POTENTIAL CITIZEN INITIATED LEGAL ACTION AGAINST AGRICULTURAL POLLUTION

West Virginia University, Missouri University.
D. Colyer, and D. R. Levi.
Waste Management Research, Proceedings of the 1972 Cornell Agricultural Waste Management Conference, Ithaca, New York, p. 83-95. 37 ref.

Descriptors: *Regulation, *Legal aspects, *Control, *Pollution abatement *Common law, Discharge.
Identifiers: *Citizen initiated legal action, *Agricultural pollution, *Mandamaus, Class action, Constitutional provisions, Public trust doctrine.

Feasible individual or group action against pollution is outlined. Citizens may seek a judicial decree constraining administrators to perform environmentally-related duties, usually through mandamus, or bring direct suit against a polluter. Plaintiffs may sue polluters under nuisance laws, illustrating intentional and unprivileged entry onto land, or under trespass laws, requesting an injunction, damages or both. They may also utilize class or declatory judgment actions. The Refuse Act of 1900, and the ninth amendment to the Constitution have also guaranteed the rights of the individual to a clean environment. (Lynch-East Central).

1274 - B1, F2, F3

DAIRY FARMER CONCERNS OF LAWS AND REGULATIONS AFFECTING ANIMAL WASTE MANAGEMENT

National Milk Producers Federation.
J. B. Adams
Waste Management Research, Proceedings of the 1972 Cornell Agricultural Waste Management Conference, Ithaca, New York, p. 97-100.

Descriptors: *Dairy industry, *Farm wastes *Regulation, *Legislation, *Water pollution, *Waste disposal, Permits.
Identifiers: *Waste management, National Milk Producers Federation, U. S. Public Health Service.

The National Milk Producers Federation has adopted an environmental issues policy which recognizes the need for reasonable balance between animal agriculture, costs to consumers, and future environmental quality. Dairymen face a problem in complying with conflicting federal regulations. According to the U. S. Public Health Service, in order to maintain a license to produce Grade "A" milk, a dairy must regularly remove and deposit manure on the land. On the other hand, most water pollution regulations require a retention of the manure or other means of preventing animal wastes' entrance into public waters. Obviously, dairymen can't comply with both regulations at the same time. Many regulations also require a permit to discharge animal wastes into navigable waterways. This "across the board approach" fails to accomodate the flexibility required to enable producers to employ practical solutions to individual problems. (Marquard-East Central).

1275 - D2, E4, F1

PYROLYSIS AS A METHOD OF DISPOSAL OF CATTLE FEEDLOT WASTES

Midwest Research Institute.
W. Garner, C. E. Bricker, T. L. Ferguson, C. J. W. Weigand, A. D. McElroy.
Waste Management Research, Proceedings of the 1972 Cornell Agricultural Waste Management Conference, Ithaca, New York p. 101-123. 7 fig, 5 tab, 10 ref.

Descriptors: *Farm wastes, *Waste disposal, *Feed lots, *Cattle, *Cost analysis, Cellulose, Lignin, Differential thermal analysis,
Identifiers: Pyrolysis, Hemicellulose, Thermogravimetric analysis, Organic fractions.

A program was conducted to determine the economic feasibility of pyrolyzing feedlot wastes. Background theory on pyrolysis of cellulose, hemicellulose and lignin, and wood is given. The pyrolysis process is pictured and diagramed and test results are given. Composition of noncondensables, elemental analyses, material and energy balance, and economic evaluation of a pyrolyzer for manure from a 40,000 head beef cattle feedlot are given. The conclusion was that pyrolysis of feedlot wastes was uneconomical in relation to simple incineration because cost of equipment to separate potential marketable material was not offset by the market value of the materials. (Marquard-East Central).

1276 - B1, D1, E1, F4

DAIRY MANURE WASTE HANDLING SYSTEMS

A. Grimm
Waste Management Research, Proceedings of the 1972 Cornell Agricultural Waste Management Conference Ithaca, New York, p. 125-144, 1 fig, 3 tab, 7 ref.

Descriptors: *Dairy industry, *Waste disposal, Waste treatment, Aeration, Activated sludge, Incineration, Cattle.
Identifiers: *Dairy manure, *Waste handling systems, *Centralized dairies, *Decentralized dairies, Dirt corrals, Paved corrals, Direct disposal, Dewater solids, Compost, Liquid flush, Oxidation ditch, Dairymen's Fertilizer Cooperative Pyrolysis, Southern California, Cerritos, California.

Because of complete urbanization of such areas as Cerritos, California, a program was initiated in southern California to study and demonstrate improved methods of handling raw manures at individual dairies and feedlots in highly populated areas. Individual system's costs are presented in tabulated form. Evaluations were made for ten decentralized individual dairy waste handling systems: four for a dirt corral dairy and six for a paved corral dairy. Eight centralized, regional dairy waste handling systems were analyzed. A schematic shows a comparison of environmental effects of waste handling systems and system operating cost. The conclusions of the study were: (1) disposal of manure from each decentralized dairy should be accomplished in the most economical manner with the least detrimental environmental effect, and (2) in view of a diminishing number of dairies, construction and operation of a centralized waste disposal plant did not appear justified in the Cerritos area. (Marquard-East Central),

1277 - C1, D1

AERATION RATES FOR RAPID COMPOSTING OF DAIRY MANURE

United State Department of Agriculture.
G. B. Wilson and J. W. Hummel
Waste Management Research, Proceedings of the 1972 Cornell Agricultural Waste Management Conference, Ithaca, New York, p. 145-158. 12 fig, 2 tab, 9 ref.

Descriptors: *Dairy industry, *Farm wastes, Chemical oxygen demand, Nitrates, Ammonia.
Identifiers: *Composting, *Aeration rates, *Bench composter *Bin composter, *Mechanized channel, Oxygen consumption rate.

Studies were undertaken to develop design criteria for composting operations. Bench composters, bin composters, and a mechanical channel were the three methods used for development of aeration rates. A generalized curve was developed showing the effects of aeration on temperature and rate of oxygen consumption at any one time during the process. Aeration rates should vary in the process in the following sequence: (1) during warmup stage, aeration should be applied at increasing rates; (2) when thermophilic temperature is reached, the aeration rate should be increased to the top of the temperature limit: and (3) as the level of activity decreased the rate of aeration should be reduced to prevent cooling. (Marquard-East Central).

1278 - C1, D4

WINDROW COMPOSTING OF SWINE WASTES

Cornell University.
J. H. Martin, Jr. and M. Decker, Jr. and K. C. Das
Waste Management Research, Proceedings of the 1972 Cornell Agricultural Waste Management Conference, Ithaca, New York, p. 159-172. 10 fig, 5 tab, 7 ref.

Descriptors: *Hogs, *Waste treatment, Hydrogen ion concentration.
Identifiers: *Composting, *Swine wastes, Windrow, Thermophilic environment, adulteration.

A study was performed to determine the feasibility of composting swine wastes. Criteria for evaluation were control of odors, time required for stabilization, volume reduction, and characteristics of the end product. Evaluation of the composting process was accomplished in two phases: (1) windrow formation creating aerobic conditions conducive to thermophilic activity and (2) maintenance of conditions for rapid stabilization. The findings were: (1) a direct correlation was observed between odor control and development of thermophilic environment; (2) increasing the turning frequency had a significant effect on the composting process; (3) adulteration of the material was successful in reducing the time before odors were controlled and minimizing time for completion when straw was used; (4) volume reduction and final material was satisfactory, and (5) composting can be a satisfactory method for treating swine manure and provides an alternative to liquid systems, (Marquard-East Central).

1279 - A5, A6, A8, B1

REDUCTION IN MOISTURE AND DAILY REMOVAL OF WASTES FROM CAGED LAYING HENS

A. D. Longhouse
West Virginia University.
Waste Management Research, Proceedings of the 1972 Cornell Agricultural Waste Management Conference, Ithaca, New York, p. 173-185. 9 fig, 6 tab.

Descriptors: *Farm wastes, *Waste disposal, Ammonia.
Identifiers: *Caged laying hens, *Moisture reduction, Vertically tiered cages, Dryer conveyor, Dropping boards, Scraper.

Research objectives were to remove manure daily from laying hens in vertically tiered cages and to begin moisture removal promptly, thus preventing odor development (especially of ammonia) and restrictive vectors. To accomplish these objectives, the research facility was equipped with a dryer-conveyor, dropping boards, a scraper mechanism, and an automatic control for solenoid steam valve. Figures show construction design. Results of a five-day test are tabulated. The research, at this time indicates that it is possible to eliminate odors and flies in a poultry house when the manure is removed at least once daily, thus making it possible to increase the bird population 25 to 100 percent—thereby paying for added mechanization. (Marquard-East Central).

1280 - A5, D2

UNDERCAGE DRYING OF LAYING HEN MANURE

Cornell University.
A. T. Sobel
Waste Management Research, Proceedings of the 1972 Cornell Agricultural Waste Management Conference, Ithaca, New York, p. 187-200, 12 fig, 2 tab, 3 ref.

Descriptors: *Forced drying, *Farm wastes, *Poultry, *Attractants, *Waste disposal, Odor, Particle size, Particle shape, Temperature.

Identifiers: *Undercage drying, *Laying hen manure, Fins, Screens, Slot outlets Air velocity, High-rise laying house, Bird concentration.

Two systems for undercage drying of chicken manure were investigated. The first system employed mechanical devices and no forced air. Test results indicated metal fins placed at angles beneath cages offer more efficient drying than mesh screen. Percentage results of various angle are listed. The second system utilized forced air drying in bird rooms with slot outlets and a high rise laying house. This was the only system studied on a full size field operation. An average drying curve for undercage drying with forced air and slot outlets and a summary of moisture contents obtained for various undercage drying systems are presented in schematics. Observations from the study indicate (1) the high-rise house presented the largest range of moisture contents, (2) shallow bed system (forced air) presented the smallest range of moisture, and (3) all the systems removed moisture to moisture contents below 60 percent. (Marquard-East Central).

1281 - B3, C5, E1

STORAGE OF MANURE SOLIDS BY FORMING SOIL-MANURE PELLETS

Iowa State University,
R. D. Larson, T. E. Hazen and J. R. Miner
Waste Management Research, Proceedings of the 1972 Cornell Agricultural Waste Management Conference, Ithaca, New York, p. 201-210. 5 fig. 5 tab, 5 ref.

Descriptor: *Hydraulic transportation, *Farm wastes, *Waste storage, Moisture content, Physical properties, Hydrogen ion concentration, Nitrogen, Carbon dioxide, Ammonia.
Identifier: *Soil-manure pellets, Hydrated lime, Webster silty clay loam, Volitalization.

A progress report is made which concerns moisture content, pH effects and nitrogen/CO2 evolution in the pelleting process of animal manure. Soil and lime are added to manure solids to help produce pellets. Soil is used as a dewatering and binding agent to control moisture content and lime is used to increase pH. Nitrogen/CO2 evolution is tested by 5 and 10% lime treatments. Conclusions are: (1) Addition of lime increases ammonia loss from a soil, lime and manure mixture; the rate of evolution increases significantly above pH 11. Moisture content does not greatly effect rate of evolution. (2) Biological activity, represented by carbon volatilization increases with the addition of 2.5% d.b. hydrated lime. Further lime additions decrease activity. At the 10% lime level, growth is arrested. Little or no growth occurs above pH 9. In most treatments, moisture-content increases were accompanied by marginal increases in carbon-dioxide evolution. (3) Manure solids exhibit a buffering capacity. The solids have an ability to retard pH increases with increasing lime contents. A pH range from 9 to 11 would be desirable in order to mutually minimize ammonia and carbon evolution. (Marquard-East Central).

1282 - A2, A4, C3

CHEMICAL STUDIES OF SOLIDS, RUNOFF, SOIL PROFILE AND GROUNDWATER FROM BEEF CATTLE FEEDLOTS AT MEAD, NEBRASKA

United States Department of Agriculture, Purdue University.
T. M. McCalla, J. R. Ellis, C. B. Gilbertson, and W. R. Woods
Waste Management Research, Proceedings of the 1972 Cornell Agricultural Waste Management Conference, Ithaca, New York, p. 211-223. 5 fig. 5 tab, 5 ref.

Descriptors: *Feedlots, *Agricultural runoff *Soil profile, *Slope, *Continuous flow, *Chemical properties, Groundwater, Nitrogen, Phosphorous, Solid wastes, Cattle, Nebraska.
Identifiers: *Batch system, *Settleable solids, Cattle density, Electrical conductivity.

This 4-year study at Mead, Nebraska, was made to determine the effects of cattle density and slope on possible pollution of surface water, soil profile, and groundwater from beef cattle feedlots. The batch system and the continuous flow system were used for removal of settleable solids from runoff. Chemical analyses were made of the wastes and runoff produced by these two systems. Conclusions were:

1. Feedlot runoff transports excess nutrients and must not be discharged into streams.
2. The quantity of volatile solids and nitrogen and phosphorous removal rates from the feedlot surface were proportional to stocking rate during mechanical cleaning.
3. An increase in the slope of the feedlot increased the quantity of total solids, volatile solids, nitrogen and phosphorous removed from the feedlot.
4. The runoff data on these lots indicate that the variability is too great to determine the effect of feedlot slope on runoff quantity and quality.
5. Beef cattle feedlots with heavy, constant stocking on loess hills do not create a groundwater problem but nitrate buildup was found in profiles of adjacent areas.
6. The soil texture of the retention structure and the procedure and materials used to seal the structure are necessary considerations in preventing nitrate accumulations in the soil profile and groundwater. (Marquard-East Central).

1283 - A2, C3

BEEF BARNLOT RUNOFF AND STREAM WATER QUALITY

United States Department of Agriculture.
R. K. White, and W. M. Edwards
Waste Management Research, Proceedings of the 1972 Cornell Agricultural Waste Management Conference, Ithaca, New York, p. 225-235. 6 fig. 1 tab, 6 ref.

Descriptors: *Biochemical oxygen demand, *Chemical oxygen demand, *Water quality, Cattle, Ohio.
Identifiers: *Barnlot runoff, *Volatile solids, *Total solids, Clarksburg silt loam.

Objectives of the study presented were to determine the concentration and amounts of solids and organic material in the runoff from a barn lot and to identify the effect of rainfall and runoff patterns and seasonal conditions on barnlot runoff quality. Runoff for a 16-month period from a 60 head beef cattle barnlot located on silt loam was sampled and analyzed for total solids (TS), volatile solids (VS), biochemical oxygen demand (BOD), and Chemical oxygen demand (COD). Runoff usually occurs when rainfall exceeds .5 inches. Transport of TS is related to the volume of runoff. BOD concentration and transport are larger in winter and smaller in summer except for the periods following dry antecedent conditions. Concentrations of TS, BOD, and COD are variable within a runoff event. Average yearly runoff, based upon 3 year records is presented. A yearly BOD concentration curve for runoff is projected. An estimate of yearly transport of BOD can be projected from these two relations. (Marquard-East Central).

1284 - B2, D4, E2

AUTOMATED HYDRAULIC WASTE-HANDLING SYSTEM FOR A 700-HEAD SWINE FACILITY USING RECIRCULATED WATER

Iowa State University,
J. K. Koelliker, J. R. Miner, T. E. Hazen, H. L. Person, and R. J. Smith.
Waste Management Research, Proceedings of the 1972 Cornell Agricultural Waste Management Conference, Ithaca, New York, p. 249-261. 8 fig. 1 tab, 6 ref.

Descriptors: *Hogs, *Recirculated water, *Farm wastes, *Waste storage, *Waste disposal, Irrigation, Estimated costs, Iowa.
Identifiers: *Automated hydraulic waste-handling system, Flush tanks, Sewer lines, Anaerobic lagoon, Return water system Slatted floors.

A swine waste handling system is described that for four years has operated with little attention, no handling of manure, low odors, and no effluent discharge into streams. The system uses an enclosed building in which swine waste is deposited into gutters. Flush tanks automatically flush the water into sewer lines and then to an anaerobic lagoon. From here some waste goes into the irrigation system for land disposal and lagoon effluent is returned to the flush tanks. Investment in the entire manure management system is estimated at $10-$15 per hog capacity, Detailed description and costs of the system are given. (Marquard-East Central).

1285 - A2, B1, C5, D4, E2

OPERATIONAL PROBLEMS OF PORK PRODUCTION RELATED TO ENVIRONMENTAL QUALITY

Gehlbach Pork Farms, Inc.
A. E. Gehlbach.
Waste Management Research, Proceedings of the 1972 Cornell Agricultural Waste Management Conference, Ithaca, New York, p. 263-265.

Descriptors: *Hogs, *Farm wastes, *Waste disposal, Confinement pens, Oxidation lagoons, Lagoons.
Identifiers: *Environmental quality, *Operational problems, *Soil injection, Pasture system, Collection pits.

A comparison is made of two pork production systems—the pasture system and the confinement system. An operational problem of the pasture system is that heavy rains wash runoff into streams. The confinement system can prevent this and can dispose of waste in these ways: (1) collection pits, (2) oxidation ditches (3) lagoons. Problems of these are costs and inability to use them year round. Gehlbach Swine Farms uses soil injection to prevent runoff and odor; however, research is needed to solve these waste disposal problems: (1) find limits of animal waste applications to land, (2) prevent odor from swine buildings and (3) find proper operating procedures for lagoons. (Marquard-East Central).

1286 - C5, D4, F1

TREATMENT OF SWINE WASTES

Schuster Farms.
L. R. Schuster
Waste Management Research, Proceedings of the 1972 Cornell Agricultural Waste Management Conference, Ithaca, New York, p. 267-270.

Descriptors: *Hogs, *Farm wastes, *Waste treatment, Confinement pens, Poultry, Bichemical oxygen demand, Costs.
Identifiers: Tank-aerator, Schuster Farms.

Schuster Farms' manager reports that the swine aerator system was chosen as a means of waste treatment due to: (1) Closed loop with zero runoff, (2) Adaptability to existing facility, (3) Ready accessibility for maintenance,(4) Ease of operations. Tank design and aeration rates are given for a 100 sow operation. Water area of the system is 18x38x10 ft. and with the waste containing a five day biochemical oxygen demand of 33,000 mg/1 and an oxygen uptake rate of 43 mg/1/hr., the system requires transfer of 21.5 lbs. of oxygen per hour at 20 degrees centigrade. Based on this, pumps must be capable of pumping at least 635,000 gal/hr. or the equivalent of turning over the tank's content once every 4.7 minutes. Costs and savings through use of such a system are discussed. (Marquard-East Central).

1287 - B2, C1, C5, D4

AN EVALUATION OF THREE HYDRAULIC MANURE TRANSPORT TREATMENT SYSTEMS, INCLUDING ROTATING BIOLOGICAL CONTACTOR, LAGOONS AND SURFACE AERATORS

Iowa State University.
H. L. Person, and J. R. Miner
Waste Management Research, Proceedings of the 1972 Cornell Agricultural Waste Management Conference, Ithaca, New York, p. 271-288. 5 fig, 9 tab, 1 ref.

Descriptors: *Hogs, *Farm wastes, *Waste treatment, *Waste water treatment, Lagoons, Confinement pens, Nitrogen, Ammonia, Rotating biological contactor, Chemical oxygen demand, Biochemical oxygen demand, Effluent, Iowa.
Identifiers: *Hydraulic manure transport systems, Anaerobic lagoon, Aeration basin, Recycled water, Flushing gutters, Surface aerators, Bilsland Memorial Research Station.

Three different waste treatment systems that use flushing gutters and recycled treated waste waters for cleaning are reported. System 1 uses flushing gutters and an aeration basin; system 2 uses flushing gutters, an anaerobic lagoon and a rotating biological contactor. Each system is diagramed and specific details and dimensions are given. Effectiveness of the three systems in terms of effluent control is summarized. It was found that (1) discharging effluent down flushing gutters was an effective means of removing manure from swine buildings, (2) treated effluent did not inhibit normal swine growth, (3) recycled wastes did not cause excessive odor problems, (4) the effluent from the RBC system and lagoon, aeration-basin system presented a few pumping problems, and (5) the aeration-basin effluent contained more solids and had clogged return lines more frequently. (Marquard-East Central).

1288 - A5, D2, E3, F1

DRYING POULTRY MANURE AND REFEEDING THE END PRODUCT

J. F. Bergdoll
Waste Management Research, Proceedings of the 1972 Cornell Agricultural Waste Management Conference, Ithaca, New York, p. 289-293.

Descriptors: *Poultry, *Farm Wastes, *Recycling, Nitrogen, Costs, Nutrients, Odor, Fertilizers Indiana.
Identifiers: *Refeeding, *Dried poultry manure.

Berry Best Egg Company's program for drying poultry manure into a feed is reported. The manure is dried to a 10-15% moisture content No odor is reported when 10% level is reached; however, from the 12-15% moisture level, there is a slight smell. Cost for a dryer runs from $22,000 to $70,000 and total operational costs run from $15 to $35 per ton. Nutrient Value/Nitrogen is highest when manure is dried daily. Optimum level for waste in a feed ration is 10 to 15%; however, it is recommended that birds should start eating a ration at eight weeks of age and work up ot a 30% level. Egg production results are given. (Marquard-East Central).

1289 - C1, C5, E3

THE EFFECTS OF CONTINUOUS RECYCLING AND STORAGE ON NUTRIENT QUALITY OF DEHYDRATED POULTRY WASTE (DPW)

Michigan State University,
C. J. Flegal, C. C. Sheppard, and D. A. Dorn
Waste Management Research, Proceedings of the 1972 Cornell Agricultural Waste Management Conference, Ithaca, New York, p. 295-300. 5 tab, 5 ref.

Descriptors: *Poultry, *Farm wastes, *Waste storage, *Nutrients, Calcium, Phosphorous, Nitrogen.
Identifiers: Continuous recycling, *Dehydrated poultry wastes, Crude protein.

One experiment was conducted to determine the influence of poultry waste storage time on the nutrient quality of dried poultry wastes. Another experiment tested what continuous recycling does to dried poultry waste nutrient quality. In the first experiment, droppings were collected and stored prior to drying from periods ranging from 1 to 90 days. In general, when the material was held for longer than 28 days, crude protein content went down. In experiment 2, pullets were fed rations for 412 days. The diets containing DPW were continuously recycled. At the completion of 31 cycles, the proximate analyses of the DPW from the birds fed the continuously recycled DPW were quite similar. However, both calcium and phosphorous were slightly higher than DPW from hens fed a standard cage laying ration. Hen housed egg production of the birds fed the 12.5 percent DPW diet was slightly higher than the hen housed egg production of the other birds. Birds fed the diet containing 25 percent DPW consumed the most feed. Mortality of the birds fed the three diets ranged from 6.9 percent to 7.9 percent. (Marquard-East Central.

1290 - E3, F1

EVALUATION OF DEHYDRATED POULTRY MANURE AS A POTENTIAL POULTRY FEED INGREDIENT

Cornell University.
M. C. Nesheim
Waste Management Research, Proceedings of the 1972 Cornell Agricultural Waste Management Conference, Ithaca, New York, p. 301-309. 7 tab, 6 ref.

Descriptors: *Poultry, *Farm Wastes, *Feeds, *Recycling, *Evaluation, Economics, Amino acids, Phosphorus.
Identifiers: *Refeeding, *Dehydrated poultry manure, *Metabolizable energy, Egg production, Feed consumption.

Cornell experiments were made to evaluate poultry waste as a poultry feed ingredient. The experimenters felt that the metabolizable energy content of the poultry waste was the best single overall measure of its potential value as a feed ingredient. Test hens were fed computer formulated rations of which diets 1, 2, and 4 were low energy content while diet 3 was a typical commercial energy diet. Diets 1 and 4 had 22.5% poultry waste as an ingredient of their rations. Results revealed that egg production was high for all four diets; however, hens on diets 1, 2, and 4 ate more than those on diet 3. There was also a marked increase in excreta dry matter for these hens. This indicated that only a portion of the manure was actually lost in recycling. The computer analysis indicated that poultry waste would be used as a preferred source of phosphorus in the ration until it reached a cost of $26.00 a ton with the feed ingredients used. Its high phosphorus content along with the associated amino acids and energy made it a preferred source of phosphorus in the ration compared to meat meal and decalcium phosphate. (Marquard-East Central).

1291 - A5, B1, F3

OPERATIONAL PROBLEMS OF POULTRY PRODUCTION RELATED TO ENVIRONMENTAL QUALITY

Kreher Poultry Farms.
H. J. Kreher
Waste Management Research, Proceedings of the 1972 Cornell Agricultural Waste Management Conference, Ithaca, New York, p. 311-316.
Descriptors: *Waste disposal, *Poultry, *Air pollution, *Odor, *Legal aspects, Technology, Ozone, New York.
Identifiers: *Operational problems, *Environmental quality, Liquid manure spreader, Soil injection.

Waste disposal is the main operational problem of Kreher Poultry Farms, a 60,000 hen poultry farm in New York. When land disposal of liquid manure became objectionable to a nearby population, ozone treatment was used to reduce odors. Due to maintenance breakdowns, the odors persisted and the farm owners were taken to court. The owners were faced with a $200 settlement for their violations. These owners feel that this was an unfair judgement and that there is a desperate need for an objective third party—an agriculture industry panel made up of people acquainted with agricultural problems and agricultural research. Such a council could give sound recommendations to farmers in trouble. (Marquard-East Central).

1292 - A5, B2, D4, E2

AUTOMATED HANDLING AND TREATMENT OF SWINE WASTES

The Ohio State University.
E. P. Taiganides, and R. K. White.
Waste Management Research, Proceedings of the 1972 Cornell Agricultural Waste Management Conference, Ithaca, New York, p. 331-339. 12 fig.

Descriptors: *Hogs, *Farm Wastes, *Waste treatment, *Oxidation lagoons, Odor.
Identifiers: *Automated handling, Flushing gutters, Recycled waste water, Siphon tanks.

A plant was constructed on Botkins Feed and Grain Company Research Farm, Botkins, Ohio, in order to study the feasibility of automatically removing swine wastes, treating them, and recycling treated effluent back to the building to flush out further wastes. The plant operated as follows. A tank located at the end of the gutter was filled with water which was siphoned onto the gutter. The flushing water carried the dung defecated on the gutter to a sump from where the waste water was pumped onto a stainless steel screen. At the screen, the solids were separated from the liquids. Liquids were discharged into the oxidation ditch, clarified and the supernatant from the final clarifier was pumped back into the siphon tanks in the animal building. Meanwhile the solids separated by the screen were aerobically digested, stored, and pumped onto crop land. After twenty weeks of operation, the automated removal of waste was working extremely well and odor control was good, but the oxidation ditch was malfunctioning and foaming. At the time of this report, it was hoped that the system would be monitored two more years and that procedures would be developed to make the plant operate optimally at all times. (Marquard-East Central).

1293 A9, B1, C5, D4, E2

EVALUATION OF SWINE WASTE TREATMENT ALTERNATIVES

North Carolina State University.
F. J. Humenik, R. W. Skaggs, C. R. Willey, and D. Huisingh.
Waste Management Research, Proceedings of the 1972 Cornell Agricultural Waste Management Conference, Ithaca, New York, p. 341-352. 1 fig, 11 tab, 6 ref.

Descriptors: *Hogs, *Farm wastes, *Waste treatment, *Evaluation, *Waste disposal, Nitrogen Chemical oxygen demand, Phosphorus, Heavy metals.
Identifiers: *Land disposal, *Unaerated lagoons, *Application rates, Cecil sandy loam, Norfolk sandy loam.

This North Carolina study reports on the treatment of swine waste by a single unaerated lagoon, the treatment of swine waste by an unaerated series lagoon system, and data for land disposal of effluent from a single unaerated lagoon. The experiment revealed that an unaerated series lagoon can handle twice the number of animals that a single aerated lagoon can take care of and there is no increase

in odor. Specific conclusions drawn from the study were:
(1) Major constraints in using lagoon systems in the Southeast are the disposal of excess liquid and the potential of odor and excess leakage.
(2) A conservative estimate of allowable nitrogen loading when using land disposal of wastes in the Southeast appears to be 15 lb./acre/week for Cecil sandy loam and 10 lb./acre/week for Norfolk sandy loam.
(3) Heavy metal feed additives can pose an environmental and health hazard, i.e. the copper content of the soil-plant disposal system may approach levels that poison the soil and/or are toxic for sheep and other animals. However, lagoons can be utilized as a copper trap prior to land disposal. (Marquard-East Central).

1294 - B2, C1, D4

DEVELOPMENT OF A SYSTEM AND A METHOD FOR THE TREATMENT OF RUNOFF FROM CATTLE HOLDING AREAS

Kappe Associates, Inc., Rockville, Maryland.
D. S. Kappe.
Waste Management Research, Proceedings of the 1972 Cornell Agricultural Waste Management Conference, Ithaca, New York, p. 353-363. 2 fig. 2 tab.

Descriptors: *Waste treatment *Farm wastes, *Agricultural runoff, *Waste disposal, *Cattle, *Dairies, *Confinement pens, Aerobic treatment, Anaerobic conditions, Sludge, Hydrogen ion concentration, Chemical properties, Economics, Maryland.
Identifiers: *Waste management research, *Aeration tank.

At the time of this paper's presentation, Kappe Associates Inc, and J. L. Mills Brooklawn Dairy Farm had just completed construction of a dairy farm waste treatment system. A description is given of the project site, the experimental treatment system, and the studies that were to be made. The treatment system consisted of a concrete flow metering box; an aerated grit chamber; a dual section aeration tank with a hopper bottom; a chlorine contact tank, a pump and piping system that enabled treated and chlorinated waterwaste to be used for washing down the treatment facility and flushing the holding area; and a small building, which housed two blowers for supplying air to the aeration tank; the chlorinator for the facility; the treatment system electrical control panel; an air flow meter for measuring the air flow to the aeration tanks; a wastewater flow recorder; and other mechanical equipment; as well as the project site laboratory. The system was designed essentially to utilize the extended aeration modification of the activated sludge waste treatment process and to operate on a "fill-and-draw" basis. The treatment methods to be studied were based on biological processes or combination of biological processes. (Marquard-East Central).

1295 - B1, D1, E1, F4

EVALUATION OF BEEF WASTE MANAGEMENT ALTERNATIVES

Oklahoma State University, Stillwater Oklahoma.
A. R. Butchbaker; J. E. Garton; G. W. A. Mahoney; and M. D. Paine.
Waste Management Research, Proceedings of the 1972 Cornell Agricultural Waste Management Conference, Ithaca, New York, p. 365-384. 7 fig. 6 tab, 21 ref,

Descriptors: *Cattle, *Farm wastes, *Waste treatment, *Waste disposal, *Waste storage, Climates, Slurries, Costs, Agricultural runoff, Solid wastes, Farm lagoons, Legal aspects.
Identifiers: *Waste management alternatives, *Confinement buildings, Open feedlots, Site selection.

Waste management design alternatives are outlined for both open and housed feedlot feeding facilities. Among the major conclusions are these: (1) No treatment systems for liquid feedlot wastes produce an effluent suitable for discharge to a stream. (2) Areas where moisture deficit is greater than 10 inches, have high potential for using evaporation for ultimate control wastes. (3) Paving open feedlots reduces pen surface area and runoff control structure sizes to about one-third of the area and sizes required for unpaved feedlots. (4) Confinement buildings offer a high potential for pollution control. Capital costs are higher than for open feedlots, but land areas are reduced, rainfall runoff structures are unnecessary and wastes may be removed either as a semisolid or as a slurry. (5) A slurry hauling system utilizing soil injection for handling liquid wastes from storage pits provides an optimum system for abatement of odors and water pollution, but is more expensive and slower than surface spreading. (6) A manure irrigation system for pumping a slurry or wastewater for field application costs about one-half as much as mechanically hauling and spreading a slurry within one-half mile of the feeding facilities. (7) Ultimate disposal of feedlot waste on agricultural land should be encouraged. (Marquard).

1296 - A2, B1, C1, D-4, E2

CHARACTERISTICS OF WASTES FROM SOUTHWEST BEEF CATTLE FEEDLOTS

Texas Tech University.
Dan M. Wells; George F. Meenaghan; Robert C. Albin; Eugene A. Coleman; and Walter Grub.
Waste Management Research, Proceedings of the 1972 Cornell Agricultural Waste Management Conference, Ithaca, New York, p. 385-404. 5 fig. 17 tab.

Descriptors: *Feed lots, *Farm wastes, *Southwest U. S., *Waste treatment, *Waste disposal, Feeds, Slopes, Semiarid climates Texas.
Identifiers: *Concrete-surfaced feedlots, *Dirt-surfaced feedlots, Waste characteristics, Composting.

Texas studies conducted on concrete-surfaced feedlots and on dirt-surfaced feedlots with varying degrees of slope yielded the following conclusions: (1) Pollutant concentrations of runoff are in a range of one to more than two orders of magnitude higher than concentrations found in untreated municipal sewage. (2) Treatment of runoff from Southwestern cattle feedlots is infeasible. (3) Concentrations of pollutants in runoff resulting from precipitation on concrete-surfaced lots are two to four times greater than corresponding concentrations from dirt-surfaced lots. (4) The quantity of solid waste accumulating on the feedlot floor is a direct function of the fraction of roughage in the finishing ration. (5) The fraction of incident precipitation running off concrete lots is twice the fraction running off dirt-surfaced lots. (6) Stocking rates above 40 square feet per animal on concentrate lots do not enhance animal performance. (7) Limited feeding trials utilizing a roof to eliminate runoff had no effect on cattle performance. (8) Increasing slope of concrete feedlots from 7½ to 15 percent makes lots virtually self-cleaning. (9) Aerobic composting of solid wastes is technologically feasible regardless of the type of operation. (10) Extreme caution must be exercised in application of feedlot runoff to agricultural crops. (Marquard-East Central).

1297 - B2, C5, D2

INITIAL OBSERVATIONS OF SEVERAL MEDIUM SIZED BARRIERED LANDSCAPE WATER RENOVATION SYSTEMS FOR ANIMAL WASTES

Michigan State University.
A. E. Erickson; J. M. Tiedje; B. G. Ellis; and C. M. Hansen.
Waste Management Research, Proceedings of the 1972 Cornell Agricultural Waste Management Conference, Ithaca, New York, p. 405-410. 1 fig, 2 tab, 2 ref.

Descriptors: *Waste water treatment, *Waste disposal, *Farm wastes, *Water pollution, *Soil contamination, *Nitrogen, *Phosphorus, Dentrification, Carbon, Livestock, Hogs, Nitrates, Effluent, Aquifer.
Identifiers: *Barriered Landscape Wate Renovation System (BLWRS).

Adsorption and filtering action of soils can be used to renovate waste water, but the expense of land and its management, as well as land availability in many places, has forced the intensive spreading of wastes on limited acreages with the possible pollution of water resources. Because there is a need for a method of renovation which is more efficient, doesn't require such large land areas, and is not as expensive as conventional sewage treatment and disposal, BLWRS (Barriered Landscape Water Renovation System) has been developed. It consists of a limestone or slag covered mound of soil underlain by an impervious water barrier. BLWRS's method is relatively inexpensive to construct, requires a minimum of maintenance, requires a smaller area than is needed for irrigation spreading systems, and removes large amounts of the nitrogen, carbon and most of the phosphate from the local environment. Tests are too incomplete for BLWRS's to be used commercially, but so far its nitrogen and phosphate removal capability has been as high as 99% for animal wastes. (Marquard-East Central).

1298 - C3, D3, E2

REMOVAL OF PHOSPHORUS FROM LIQUID ANIMAL MANURE WASTES

Cornell University.
Raymond C. Loehr,
Waste Management Research, Proceedings of the 1972 Cornell Agricultural Waste Management Conference, Ithaca, New York, p. 411-427. 4 fig, 2 tab, 4 ref.

Descriptors: *Farm wastes, *Liquid wastes, *Phosphorus, Waste water treatment *Waste disposal, Alum, Hydrogen ion concentration, Poultry, Ducks (domestic), Cattle, New York.
Identifiers: *Chemical removal, Alum, Ferric chloride.

This paper reports the results of detailed laboratory studies to remove phosphorus from duck, poultry, and dairy manure wastewaters and discusses the feasibility of such removal. The studies investigated the effect of phosphorus concentrations, pH control, different coagulants and wastewater source. The three chemicals used in the phosphorus removal experiments were: alum—$AL_2(SO_4)_3$; lime—CoO; and ferric chloride—$FeCL_3 6H_2O$. Actual comparison of the three chemicals was difficult since they were used in wastewaters of different characteristics and chemical demand. Chemical choice was determined by required dosage, chemical cost, and the costs of ultimate solids disposal. The alum requirements were less than those of lime for most poultry manure wastewaters; lime requirements were less for duck wastewater. Controlled land disposal should be considered a high priority method for phosphorus control from animal wastewaters because it is more amenable to normal animal production operations, avoids the need for chemical control and treatment plant operation, and eliminates additional problems of chemical costs and sludge production handling and disposal. (Marquard-East Central).

1299 - A5, C3, E2

CONTRIBUTION OF ANIMAL WASTE TO NITRATE NITROGEN IN SOIL

The Pennsylvania State University.
L. P. Marriot, and H. D. Bartlett,
Waste Management Research Proceedings of the Cornell Agricultural Waste Management Conference, Ithaca, New York, p. 435-440. 1 fig, 2 tab, 1 ref.

Descriptors: *Farm wastes, *Waste disposal, *Nitrogen, *Soils, *Rates of application, *Slurries, *Water pollution, Groundwater, Dairy industry, Odor.

Identifiers: Hagertown silt loam, Suction lysimeters.

Research was done to determine the movement and accumulation of nitrate nitrogen in soil after dairy manure slurry was applied below the surface of grass sod. Odor control was also to be determined. A liquid spreader spread slurry of 12.5% solids and 2.39% total N (dry matter basis) four inches below surface at treatment rates of 0, 15, 30, 45, 60, and 75 tons of moisture. Suction lysimeters were installed in each plot at depths of 1 2, 3, and 4 feet for the purpose of sampling soil water. Samples were taken at 14 day intervals in 1970 and at monthly intervals in 1971. Soil samples were also taken. Both types of samples were analyzed for nitrate, ammonium nitrogen, chloride, and sodium. Even the lowest application rate of 15 tons per acre indicated enough nitrate excess to be a potential pollution hazard. Disposal of wastes in this manner practically eliminated odors. (Marquard-East Central).

1300 - B3, C3, E2

HEAVY MANURE APPLICATIONS: BENEFIT OR WASTE?

Department of Plant and Soil Sciences, Massachusetts University.
M. E. Weeks; M. E. Hill; S. Karczmarczyk; and A. Blackmer.
Waste Management Research, Proceedings of the 1972 Cornell Agricultural Waste Management Conference, Ithaca, New York, p. 441-447. 6 tab, 4 ref.

Descriptors: *Farm wastes, *Waste disposal, *Rates of application, Nitrogen, Phosphorus, Salts, Connecticut, Massachusetts.
Identifiers: Manure, Corn crop, Agawam sandy loam, Hadley sandy loam Chlorides.

A study was started to determine the effects of high rates of manure on the growth and yield of corn crops and on chemical and physical change in light textured soils. Three experimental sites with sandy loam soils were used. After two years of experimenting, the following was revealed: (1) Large manure applications on well-drained sandy loam soils should not adversely affect crop growth or yield. (2) Manure applications have a favorable effect on general tilth and workability of soil, (3) Nitrates, chlorides and other salts move through the soil profile at all levels of application, though during the growing season a crop of corn would utilize much of the nutrients as they become available, probably as high as 42 tons per acre. (4) Leaching would occur mainly before the crop is established and after it is removed. (5) Annual applications of manure for purposes of disposal on crop land should be made only after due consideration is given to location and total amount of area covered. The crops themselves were not analyzed for nitrate content. (Marquard-East Central).

1301 - B3, C1, E2

EFFECTS OF SOLID BEEF FEEDLOT WASTES ON SOIL CONDITIONS AND PLANT GROWTH

Kansas State University.
L. S. Murphy; G. W. Wallingford; W. L. Powers; and H. L. Manges.
Waste Management Research, Proceedings of the 1972 Cornell Agricultural Waste Management Conference, Ithaca, New York, p. 449-464. 15 fig, 2 tab, 12 ref.

Descriptors: *Feed lots, *Farm wastes, *Waste disposal, *Nitrogen, *Nitrates, *Phosphorus, Rates of application, Nutrient removal, Plant growth, Soil chemical properties Ions, Sodium, Potassium, Cattle, Kansas.
Identifiers: Electrical conductivity, Saturation extract conductivity, Greensburg silty clay loam, Silage yields,

Results of this two-year study indicate that large applications of solid beef feedlot manure can depress yields of corn silage. Silage yields were found to have a quadratic relationship to manure applications. Maximum yields were realized between 225 and 300 MT/ha. Depressed yields were due to accumulation of salts from manures. Electrical conductivity of the soil saturation extract increased linearly with manure applications. Sodium, potassium, phosphorus, NO3-N and nitrogen were found in large quantities in the soil; however, NO3 -N and nitrogen were not in large quantities of the corn silage, while phosphorus was. Results suggest that the detrimental effects of excessive manure application may be reversed by continued cropping and adequate water penetration of the soil. (Marquard-East Central).

1302 - A2, C1, E2

GRASS RESPONSE TO APPLICATIONS OF BEEF-CATTLE FEEDLOT RUNOFF

United States Department of Agriculture.
M. B. Satterwhite, and C. B. Gilbertson.
Waste Management Research, Proceedings of the 1972 Cornell Agricultural Waste Management Conference, Ithaca, New York, p. 465-480. 3 fig, 7 tab, 27 ref.

Descriptors: *Feed lots, *Agricultural runoff, *Chemical analysis, *Rates of application, *Grasses Soil chemical properties, Nutrients, Soil profiles, Cattle, Nebraska.
Identifiers: Orchard grass, Little bluestem, Switchgrass, Reed canarygrass, Big bluestem, Intermediate wheatgrass, Brome grass, Sideoats grama, Indiangrass.

Field and greenhouse investigations were initiated to determine the response to various kinds of grasses to applications of beef feedlot runoff, Chemical aspects of the runoff, grasses tested, grass production, protein content, and soil analyses are tabulated. It was found that yearly variation in runoff could lead to death. Under controlled greenhouse conditions, grasses in order of decreasing response were: Orchard grass, Little bluestem, Switchgrass Reed canarygrass, Big bluestem, Intermediate Wheatgrass, Brome grass, Side-Oats Grama, and Indiangrass. (Marquard-East Central).

1303 - C1, E2

A STUDY OF CORN RESPONSE AND SOIL NITROGEN TRANSFORMATIONS UPON APPLICATION OF DIFFERENT RATES AND SOURCES OF CHICKEN MANURE

Cornell University.
K. MacMillan, T. W. Scott, and T. W. Bateman.
Waste Management Research, Proceeding of the 1972 Cornell Agricultural Waste Management Conference, Ithaca, New York, p. 481-494. 8 fig, 10 tab, 5 ref.

Descriptors: *Farm wastes, *Rates of application, *Nitrogen, Potassium, Poultry, Electrical conductance, Acidic soils, Salts, Hydrogen ion concentration New York.
Identifiers: Chicken manure, Soil nitrogen transformation, Corn response, Oxidation ditch manure, Diffused air manure.

A 37-day greenhouse experiment was initiated to (1) determine corn response when extremely different rates of treated manure sources were applied to two typical New York soils differing in pH and (2) determine soil nitrogen transformations under the above conditions. Raw manure was applied at rates 0, 75, 155, 310, and 620u gN/gm soil. All other sources (stored oxidation ditch manure, oxidation ditch manure, and diffused air manure) were applied at rates 0, 125, 250, 500, and 1000u gN/gm. soil. It was concluded that: (1) High rates of manure applications did not result in excessive amounts of salts nor did it destroy the microbial population. (2) Luxury Nitrogen and potassium consumption resulted from the application of high rates of the manure sources studied, (3) In low pH soils the corn grew well; in high pH soils the effect of manure application was detrimental. This suggested that acid soils have the greatest potential for manure disposal and crop efficiency. (Marquard-East Central).

1304 - A2, C5, E2

SURFACE RUNOFF NUTRIENT LOSSES FROM VARIOUS LAND DISPOSAL SYSTEMS FOR DAIRY MANURE

Agronomy Department, Cornell University.
P. J. Zwerman, S. D. Klausner, D. R. Bouldin, and D. Ellis.
Waste Management Research, Proceedings of the 1972 Cornell Agricultural Waste Management Conference, Ithaca, New York p. 495-502. 3 tab, 12 ref.

Descriptors: *Agricultural runoff, *Waste disposal, *Farm wastes, *Nitrogen, *Phosphorus, Nitrates, Dairy industry, Crop rotations, Corn, Alfalfa, Oats, Wheat, Organic matter, Rainfall simulators.
Identifiers: Nutrient losses, Manure, Soil loss Orthophosphate.

Sixty randomly selected plot locations were subject to surface runoff tests with a rainfall simulator. Storm frequencies corresponding to 2, 10, and 20 years were applied in sequence to each plot. Soil condition results represent the effects of fourteen years of past management on seed beds prepared for corn, Heavy mineral fertilization increased runoff by 50%. Lack of a 6 ton manure application increased runoff 100%. Orthophosphate was increased by increased phosphate fertilizer. Runoff, nitrate and orthophosphate increased with rain application. Increased mineral fertilization doubled the losses of soil, organic matter, total nitrogen, and total phosphorus. Six ton manure applications cut these losses in half. All losses increased with increased water applications. The two-by-four study again involved six tons of manure plowed down versus no manure on four crop rotations. All were at moderate rates of mineral fertilization. The rotations were: (1) continuous corn; (2) corn-corn-oats-alfalfa-alfalfa; (3) corn-oats-alfalfa-alfalfa; and (4) wheat-alfalfa-alfalfa-alfalfa-alfalfa. Manure effect in these rotations was non-significant. In (1) and (4), manure decreased or did not effect runoff, soil, and nutrient losses. In (2), manure significantly increased organic matter and total nitrogen loss. It increased runoff, nitrates, soil loss, and total phosphorus. In (3), manure significantly increased total phosphorus. It decreased nitrate. It increased soil loss, organic matter, and total nitrogen. (Marquard-East Central).

1305 - B2, D4

A STUDY OF FOAMING PROBLEMS IN AN OXIDATION DITCH TREATING SWINE WASTE

Toronto University,
P. H. Jones, and N. K. Patni.
Waste Management Research, Proceedings of the 1972 Cornell Agricultural Waste Management Conference, Ithaca, New York, p. 503-515. 14 fig, 2 tab, 3 ref.

Descriptors: *Farm wastes, *Swine, *Oxidation lagoons, *Foaming, *Waste treatment, Temperature, Hydrogen ion concentration, Suspended solids.
Identifiers: *Oxidation ditch, *Electronic foam sensor, Beloit-Passavant Rotor, Foam suppressants, Electrodes, Silicon controlled rectifier.

This study was conducted to examine the occurrence of foam and to determine the factors affecting foam generation in a full-scale oxidation ditch used for treatment of daily wastes of approximately 400 swine. Foam formation was monitored daily for 211 days and temperature, dissolved oxygen, pH, suspended solids, etc., were measured. A rotor operated within the ditch to promote aeration. Breaking the foam with water spray proved unsatisfactory. By the 6th week, foaming was acute. The use of winter fuel oil and commercial foam depressants proved unsatisfactory. A five feet high wooden head-box was constructed downstream of the rotor to catch the foam but proved not to be strong enough. After the winter freeze the ditch was restarted May-August, 1971. An electronic foam sensor was devised. When foam built up too much, the sensor caused the rotor to shutdown. A red warning lighted alerted farm personnel. The foam sensor, operating in conjunction with the head-box, completely eliminated foam spillovers. Little maintenance was required and the necessity of closely watching the foam was removed. (Merryman-East Central)

1306 - B1, C5, D1, E1

TREATMENT AND DISPOSAL OF SWINE WASTE

Greyhound Corporation.
T. J. Mulligan and J. C. Hesler.
Waste Management Research, Proceedings of the 1972 Cornell Agricultural Waste Management Conference, Ithaca, New York, p. 517-536. 8 fig. 4 tab.

Descriptors: *Waste treatment, *Waste disposal, *Farm wastes, *Hogs, Confinement pens, Feeds, Biochemical oxygen demand, Chemical oxyget demand, Foaming, Aerated lagoons, Anaerobic conditions, Odor.
Identifiers: *Swine Refeeding.

Several treatment systems for swine wastes are reviewed. Specific studies are cited and formulas derived. Anaerobic lagoons and aerated lagoons are found to reduce the organic contents of wastewater. Discharge of the treated settled effluent to surface waters after this type of treatment, however, is often unsatisfactory due to the nutrient content and color of the wastewater. Also, the remaining BOD, suspended solids, coliform, and salt content may be objectionable in certain receiving waters. Liquid wastewaters may be disposed of by spray irrigation or evaporation ponds. Each of these methods requires significant land area and may be accompanied by an odor problem. Wastes may be spread on the land or plowed and furrowed, but again there is a potential odor problem and large land area is required. Also in cold climates, the wastes would have to be stored until they could be deposited on the land. Wastes may be refed, but more research is needed. Many variables must be evalued in determining ultimate treatment and disposal of animal waste. Imaginative approaches to the overall waste problem are needed. (Merryman-East Central).

1307 - A5, B2, D4, E2

AEROBIC TREATMENT OF SWINE WASTE BY AERATOR- AGITATORS ("FUCHS")

Kiel University.
U. Riemann.
Waste Management Research, Proceedings of the 1972 Cornell Agricultural Waste Management Conference, Ithaca, New York, p. 537-544. 2 fig, 1 tab.

Descriptors: *Farm wastes, *Hogs, *Aerobic treatment, *Waste treatment, *Waste disposal, Odor Salmonella, Liquid wastes, Foaming.
Identifiers: *Swine, *Aerator-agitators, Liquid manure reactors.

Kiel Institute constructed an experimental plant consisting of 3 liquid manure reactors (each having a recirculating aerator), a pump sump pit, and an earth reservoir for evaporation and distribution of foam in order to investigate deodorization, biological disinfection, treatment, and disposal of pig manure through use of an aerobic treatment system. The pump sump pit received the liquid manure from the third reactor and the partially clarified liquid was distributed or directed to a storage tank. It was found that a nearly complete deodorization of fresh manure could be achieved after a daily refill or 3 m_3 fresh manure. Bacteriological investigations using salmonellae indicated that the bacteria were dead six hours after entering reactor at temperatures around 30°C. Sedimentation tests indicated that organic and inorganic flocculants have a positive effect on the separation process. Fertilization trials revealed (1) Aerated liquid manure is less corrosive than untreated manure to plants. (2) A total of 50m3/ha aerated liquid manure yields a 10% higher crop of summer barley than does the untreated. Fertilization of 150m3/ha of aerated liquid manure on sugar beets gave a slightly better result than the untreated fertilization. (5) Corn digests high liquid manure quantities. Further investigations are in progress. (Merryman-East Central).

1308 - B2 , C3, D4

NITROGEN LOSSES THROUGH DENITRIFICATION AND OTHER CHANGES IN CONTINUOUSLY AERATED POULTRY MANURE

Guelph University.
G. G. Dunn, and J. B. Robinson.
Waste Management Research, Proceedings of the 1972 Cornell Agricultural Waste Management Conference, Ithaca, New York, p. 545-554. 10 fig, 1 tab, 7 ref.

Descriptors: *Nitrogen, *Farm wastes, *Poultry, *Waste storage, *Waste treatment, Liquid wastes, *Oxidation lagoons Denitrification, Temperature, Biochemical oxygen demand, Chemical oxygen demand, Ontario.
Identifiers: *Manure, Organic loading, Loading rate, Total solids, Volatile solids.

The objectives of this study were to: (a) determine the effectiveness of pilot scale oxidation ditches in stabilizing the organic loading placed on them, and (b) determine the conditions of oxidation-reduction potential in the liquid waste under which nitrogen was eliminated. Two trials were conducted. The first lasted 138 days during winter (average ditch temperature 11°C) conditions. The second lasted 160 days under summer (average ditch temperature 18°C) conditions. Two ditches were used which had dividing partitions separating the rotor in the ditches from the birds. The rotor speed on Ditch II was fixed at 95 rpm. The rotor speed in Ditch I (which was variable) was set for the same ditch velocity. Forty-two cages housing 90-100 white leghorns were suspended over each ditch and the droppings fell directly into the ditch. The winter loading rate was 120 mg/litre/day of biochemical oxygen demand and 375 mg/litre/day of chemical oxygen demand. The summer rate was 150 mg/litre/day of BOD and 500 mg/litre/day of COD. Experimental results indicated that the oxidation ditches used in this study were adequate for storing and treating liquid chicken manure in an odor-free condition for periods up to 160 days under the experimental loading conditions. At this loading rate, losses of 70-80% of the added nitrogen could be expected with little effect of temperature in the range 11°C-18° C. (Merryman-East Central).

1309 - C5, D4, E3

SOLIDS BALANCE ON A BEEF CATTLE OXIDATION DITCH

Livestock Engineering and Farm Structures Research Branch, United States Department of Agriculture.
R. O. Hegg, and R. E. Larson.
Waste Management Research, Proceedings of the 1972 Cornell Agricultural Waste Management Conference, Ithaca, New York, p. 555-562. 3 fig, 4 tab, 7 ref.

Descriptors: *Farm wastes, *Cattle, *Oxidation lagoons Chemical oxygen demand, Biochemical oxygen demand, Hydrogen ion concentration, Liquid wastes, Minnesota.
Identifiers: *Solids balance, *Oxidation ditch, *Beef, Total solids, Total volatile solids.

The objective of this experiment was to determine the solids balance on a summer operation of an oxidation ditch for 38 beef animals which were fed a high concentrate ration. This oxidation ditch also included the removal of some of the settled solids during the experiment. The solids balance was made by comparing the total solids, total volatile solids, and fixed solids of the waste matter going into the ditch with material taken out of the ditch. Input consisted of the fecal matter (4.6 pounds dry matter per day) for each animal. The output consisted of the settled solids (partially digested corn) most of which were periodically removed during the experimental period for recycling. Total solids were reduced 30% and total volatile solids were relatively unchanged. (Merryman-East Central).

1310 - A1, B1, D4

LAGOONS FOR MILKING CENTER WASTES

United States Department of Agriculture.
R. Crowe, and R. L. Phillips.
Waste Management Research, Proceedings of the 1972 Cornell Agriculture Waste Management Conference, Ithaca, New York, p. 563-567.

Descriptors: *Lagoons, *Dairy industry, *Farm wastes, *Waste storage, *Design criteria, Waste treatment, Cattle, Biochemical oxygen demand New York.
Identifiers: *Milking center wastes, *Soil Conservation Service, *Rural Economic Assistance Program,

Rural Environmental Assistance Program cost-sharing by the federal government has spurred many requests for assistance from the Soil Conservation Service in construction of lagoons for milking center wastes. A farmer who requests assistance is usually visited by the Cooperative Extension agent, SCS, and a representative of the health department. Location and practicality of the lagoon is influenced by (a) nearest residence, (b) prevailing wind direction, (c) general soils in the area, (d) type of outlet-gravity or pumping, (e) discharge point, (f) stream location, characteristics, and classification. (g) herd size—present and future, (b) present waste disposal system and (i) estimated cost of the lagoon. Lagoon layouts are designed with a surface area of 123 square feet per cow, are usually partially below and partially above the ground, and have a length to width ratio of 3:1. Rectangular shape is most economical. Maximum depth should be 5 feet and minimum 2 feet. The bottom should be level. Once the details are worked out, a cost estimate is made and the drawings and estimate are reviewed with the landowner for his concurrence and approval. The drawings and specifications, with a summary design report and application, are then submitted to the county health department for approval. (Merryman-East Central).

1311 - A5, C5, D2, D4

PILOT PLANT COMPARISON OF LIQUID AND DRY WASTE MANAGEMENT SYSTEMS FOR POULTRY MANURE

Cornell University.
D, C. Ludington; A. T. Sobel; R. C. Loehr; and A. G. Hashimoto.
Waste Management Research, Proceedings of the 1972 Cornell Agricultural Waste Management Conference, Ithaca, New York, p. 569-580. 2 fig, 4 tab, 6 ref.

Descriptors: *Farm wastes, *Liquid wastes, *Poultry, *Odor, *Oxidation lagoons, *Waste treatment, Air pollution.
Identifiers: *Waste management systems *Undercage drying-forced air, *Undercage drying-fins, *Diffused aeration.

Two primary waste management techniques are known to control the production of odors. The first is removal of moisture from manure soon after defecation. The second is to properly aerate a liquified manure and maintain the waste in an aerobic condition. Four different systems based on these two techniques were studied: (a) oxidation ditch, (b) undercage drying-forced air, (c) undercage drying-fins, and (d) diffused aeration. These experiments proved that properly aerating a liquefied manure and removing sufficient moisture from fresh manure will control odors in a poultry house. If a high degree of odor control is necessary, then the properly aerated liquid manure system would be the one to select. If the conditions are less severe, then undercage drying may accomplish sufficient odor control at a reduced operating cost. The losses of nitrogen for the various systems may or may not be an advantage depending upon the local situation and the point of ultimate disposal. The removal of volatile solids does permit operation at a lower total solids concentration with less dilution water. Specific trials and results are outlined and tabulated. (Merryman-East Central).

1312 - C3, C4
USE OF CAISSONS FOR SAMPLING CHEMICAL AND BIOLOGICAL CONDITIONS BENEATH A BEEF FEEDLOT

Nebraska University, Lincoln,
L. F. Elliott; T. M. McCalla; N. P. Swanson; and F. G. Viets, Jr.
Transactions of the ASAE, Vol. 14, No. 6, p. 1018-1019, November-December, 1971. 4 fig, 2 tab, 2 ref.

Descriptors: *Feed lots, *Caissons, *Sampling, *Biological properties, *Soil chemical properties Surface-groundwater relationships, Soil contamination, Cattle, Soil gases.

The caisson installation allows soil gas and soil solution to be taken from the same sites, in the feedlot soil profile, over extended periods of time. These samples provide a measure of the chemistry and biological activity under a feedlot which would be extremely difficult without the benefit of the caisson installation. The sampling equipment required for this study is delicate and requires protection from the feedlot environment. To protect the instruments, large cylindrical compartments, or caissons, equipped with access ports, are inserted into the feedlot soil profile. Values obtained indicate the system will permit the measurement of the effect of feedlot management on the downward movement of pollutants, (Ballard-East Central).

1313 - A9, B3, D2
MANURE IN PIT DRIES TO 15% MOISTURE

Poultry Extension
Tennessee University
Knoxville
Charles' H. Goan
Poultry Digest, Vol. 32, No. 381, p. 506-507, November, 1973. 1 fig.

Descriptors: *Farm wastes, *Moisture content, *Drying', *Poultry', *Waste storage, *Waste treatment Aeration, Ventilation, Air circulation, Tennessee.
*Manure, *Fans, *Deep-pit poultry house, Beetles, Marek's disease.

Manure in a high-rise or deep-pit poultry house in humid Robertson County, Tennessee, dries down to a moisture level of 15%. The 44x500-foot house has a capacity' for 50,000 layers and the pit area is approximately seven feet deep. The pit is ventilated by fourteen 48 inch fans located in the side of the wall of the manure storage area. An additional fourteen 30 inch fans are located in the pit itself, Aiding in the drying process, the burrowing action of beetles of the lesser mealworm leave small holes and tunnels in the manure which are believed to greatly increase the drying process. So far the beetles have caused no problems, but because the beetles may be potential carriers of Marek's disease, chickens should be obtained that have been vaccinated against this disease. (Ballard-East Central).

1314 - A2, B1, C5
WASTE MANAGEMENT AND ANIMAL PERFORMANCE IN BEEF FEEDLOTS

Nebraska University
Nebraska Agricultural Experiment Station
Omaha
W. Woods; T. M. McCalla; C. B. Gilbertson; and J. R. Ellis.
Nebraska Beef Cattle Report, EC 72-218, p. 26-28, 1972. 2 fig, 2 tab.

Descriptors: *Feed lots, *Cattle, *Performance, *Control, Farm wastes, Density, Runoff, Consumption, Nebraska.
Identifiers: *Waste management, Slope.

At the University of Nebraska, a waste management research program was developed with these objectives: (1) to maintain or improve our environment, (2) to permit growth and development of livestock industry, and (3) to recognize that changes in animal agriculture must be economically sound. The research program measured characteristics of runoff from feedlots, percolation into the soil, and animal responses to lot surface conditions, animal density, and lot slope. At the Mead Field Laboratory, a comparison was made of 100 and 200 square feet per animal. One lot at each density was on 3, 6, and 9 percent slope. All cattle were fed the same ration to permit direct comparison of animal density and effect of slope of lot upon performance. Having cattle at 100 square feet per head reduced animal performance as compared to 200 square feet per head. At 200 square feet per head, lot surfaces were less than adequate and gains might be reduced. (Cameron-East Central),

1315 - B-3, C5
EFFECT OF CONSUMPTION OF SHAVINGS ON HEMATOLOGY OF TURKEY POULTS

Division of Poultry Science, Georgia University, Athens.
K. W. Washburn and O. W. Charles.
Poultry Science, Vol. 52, No. 3, p. 1200-1201, May, 1973. 2 tab, 6 ref.

Descriptors: *Poultry, *Feeds, *Litter, *Diets.
Identifiers: *Wood shavings, *Hematology, *Turkey poults, Basal, Folic acid, Mean cell volume, erythrocyte count, Hemoglobin, Macrocytic anemia,

An experiment was designed to study the effect of the consumption of new wood shavings on the hematology of turkey poults. The experimental design consisted of four dietary treatments—(1) basal, (2) basal with wood shavings, (3) basal with added folic acid, and (4) basal with wood shavings and added folic acid. The shavings were fed from a feeder designed for determining individual feed efficiency. The average consumption of litter from those fed the basal diet was 291 grams, while those fed with folic acid added consumed 277 grams of shavings. The hematological parameters measured were: erythrocyte counts, mean cell volume, hemoglobin concentration, and mean cell hemoglobin concentration. No significant differences in the MCV or MCHC of any of the groups indicated that the shavings consumption did not affect the hematology of turkey poults, (Cameron-East Central).

1316 - E3
WASTELAGE—SOMETHING NEW IN CATTLE FEEDING

Department of Animal Science.
Auburn University.
Auburn, Alabama.
W. B. Anthony.
Highlights of Agricultural Research, Vol. 16, No. 2, Summer, 1969. 1 fig.

Descriptors: *Feeds, *Farm wastes, *Ruminant, *Recycling, *Microorganisms, *Digestion, Cattle, Sheep, Feed lots.
Identifiers: *Wastelage, *Waste management.

The value of wastelage, a feed made by combining manure with bermudagrass hay, was established in three feeding trials. In trial one, the wastelage-fed ewes were more vigorous and healthy than the hay-fed ewes. In trial two, the corn-silage fed heifers gained more weight while nursing calves than the wastelage-fed heifers. In trial three, wastelage fed steers made the best gain. Carcasses of both groups were equal. The cattle on the standard fattening ration suffered from rumen parakeratosis while none of the wastelage-corn steers had this disorder. (Drewry-East Central).

1317 - A2, A8, D2
THE PERFORMANCE OF PRIMARY SETTLING ON LIVESTOCK FEEDLOT RUNOFF

Agricultural Engineering Department, Throckmorton Purdue Agricultural Center.
J. C. Nye; A. L. Sutton; and E. R. Baugh.
Presented at 1973 Annual Meeting, American Society of Agricultural Engineers, Paper No. 73-412, p. 7, June 17-20, 1973. 2 fig, 1 tab, 2 ref.

Descriptors: *Livestock, *Cattle, *Feed lots, *Farm wastes, *Waste treatment, Agricultural runoff, *Sedimentation, *Settling basins, Weirs, Indiana.
Identifiers: Porous dams, Fly breeding.

At Throckmorton Purdue Agricultural Center, primary sedimentation criteria were used to design a settling basin for runoff from a 200 head solid concrete beef feedlot. Sedimentation through the settling basin, consisting of three parallel chambers separated by porous dams provided for settling rates of 3, 5.5, and 11 cubic feet per hour per sq. feet of surface area for a 2-inch per hour rainfall intensity, Two problems were encountered — clogging of gravel dams, and fly breeding. A surface settling of 4 cu, ft./hr./sq. ft. and a weir loading rate of 100 cu. ft. per hr. per linear ft. were recommended as design criteria for feedlots of less than 300 head of cattle. A settling basin can be used in conjunction with lagoons in order to lower the lagoon loading. Porous dams may be eliminated by using liquid manure handling equipment to clean settling tanks. In some locations it may be possible to use this in conjunction with grass waterways and eliminate the need for lagoons or liquid handling equipment. (Drewry-East Central).

1318 - B2, C5, F1
MANAGING DEEP-PIT HOUSE TO REDUCE DRYING COSTS

Egg Industry, Vol. 6, No. 7, p. 31, 34, July, 1973. 2 tab.

Descriptors: *Farm wastes, *Poultry, *Drying, *Waste storage, *Costs, *Waste treatment, Temperature, Humidity Ventilation, Sampling, moisture content, Maine.
Identifiers: *Deep-pit poultry house, Pit, Dropping boards.

Research was done in Maine to try to reduce manure drying costs. The research was based on a study of four poultry farms, three brown-egg type houses, and one white egg. At each of the four farms, trials were run in winter, spring, and late summer. Manure samples were collected after one, two, and three-day accumulations—on both dropping boards and in the pit. Observations revealed that manure dried faster in the pit than on the boards after the first day. Manure dried to a lower moisture content during spring and summer in both pen and pit. The observations also indicated that under conditions normally present in Maine cage laying houses, the greatest amount of manure drying occurred the first day—regardless of location within the house. (Ballard-East Central).

1319 - A9, C4, C5, D4

EFFECT OF TEMPERATURE AND AERATION ON THE SURVIVAL AND GROWTH OF SALMONELLA TYPHIMURIUM IN DAIRY WASTE

Auburn University, Alabama.
M. A. Jaleel.
M. S. Thesis, Auburn University, March, 1972, 78 p. 6 fig. 3 tab, 171 ref.

Descriptors: *Mortality, Dairy industry, Period of growth, Wastes, Coliforms, Cattle *Salmonella, *Temperature, *Aeration, Pathogenic bacteria, Epidemiology, Isolation, Separation techniques, Human diseases, Animal diseases, Carriers, Water pollution, Sampling, Cultures, Hydrogen ion concentration, Oxidation-reduction potentials, Farm wastes.
Identifiers: *Salmonella typhimurium, *Dairy wastes, Salmonella survival Detection procedure.

Dissemination of Salmonella typhimurium by dairy cattle leading to water contamination prompted study of the viability of this bacterium in liquid bovine waste. Salmonella detection and enumeration procedure of Cheng, et al. was modified by concentrating the enrichment medium rather than the inoculum. Confirmation of salmonella was accomplished by inoculating the suspected colonies from brilliant green agar into triple sugar iron agar. Serological confirmation was done by using polyvalent O antiserum. Results showed that S. typhimurium survived longer (mean survival time 44.4 days) at 10°C as compared to 3.4 days at 35C. A 99% kill of S. typhimurium in the aerated sample at 10°C was much faster (18-21 days) when compared to the 99% kill in the nonaerated sample at 10°C (28-35 days). Mean survival time in aerated dairy waste at 35°C was longer (16 days) than the mean survival time in the nonaerated sample (2.4 days). A 99% reduction of salmonella in aerated waste occurred during 12-18 days of incubation whereas in nonaerated waste 99% reduction occurred between 3 and 6 days of incubation. (Jones—Wisconsin)

1320 - C5, D2

A ROTATING FLIGHTED CYLINDER TO SEPARATE MANURE SOLIDS FROM WATER

Agricultural Engineering Department, Oregon State University, Corvallis.
W. E. Verley, and J. R. Miner.
Presented at 1973 Annual Meeting, American Society of Agricultural Engineers, University of Kentucky, Lexington, June 17-20, 1973, Paper No. 73-410. 9 fig 3 tab, 6 ref.

Descriptors: *Farm wastes, *Slurries, *Water, *Waste treatment, *Waste disposal, *Sedimentation, *Separation techniques, Kinetics, Suspended solids, Oregon, Pumps, Weirs, Irrigation.
Identifiers: *Hydraulic manure transport systems, settleable solids, rotating flighted cylinder, concentrated solids, manure.

A rotating inclined tube, fitted with a helical fin on the inner surface was designed, built and tested to remove solids from liquid manure. Initially, a manure slurry of approximately 0.4 percent settleable solids was run through the device at 0.5 gallons per minute averaging a settleable solids removal of 30 percent. The design of the device was revised from 8 inches in diameter to a 24 inch diameter tube and was retested. The device offered an increased volumetric capacity, consumed little power, and was immune to plugging problems. The concept is simple and has potential applications wherever it is desired to concentrate solids or claim water for reuse. (Frantz-East Central).

1321 - A5, B3, C1, F1

THE MAINE DEEP PIT CAGE LAYING HOUSE

Extension Agricultural Engineer, University of Maine, Orono.
C. W. Kitteridge.
Presented at the 1970 Winter Meeting, American Society of Agricultural Engineers, Chicago, Illinois, December 8-11, 1970, Paper No. 70-915. 8 p. 3 fig, 1 tab, 1 ref.

Descriptors: *Farm wastes, *Poultry, *Waste storage, *Maine, Costs, Moisture, Dehydration, Drainage, Fertilizers Confinement pens, Construction.
Idenitifiers: *Deep pit caged laying houses, Manure.

The deep pit caged laying house is a feasible method of poultry waste handling in northern climates. Wastes can be removed on a yearly or two-year basis. The wastes dry to an approximate moisture content of 50% and odors are practically nil during the storage period. Excavation of the deep pit is about 8 feet. Proper drainage must be insured and basement walls and floors must be watertight. Deep pit caged laying houses are economical because of infrequent waste handling. These systems, when properly constructed and managed, have been successful in Maine. (Frantz-East Central).

1322 - C3, C5, E2

AMMONIA VOLATILIZATION AND NITROGEN TRANSFORMATIONS IN HIGH pH SOILS USED FOR BEEF MANURE DISPOSAL

U. S. Corps of Engineers, Vicksburg, Mississippi.
Robert E. Peters, and Donald L. Reddell.
Presented at the Annual Meeting, American Society of Agricultural Engineers, University of Kentucky, Lexington, June 17-20, 1973, Paper No. 73-428, 31 p. 8 fig, 9 tab.

Descriptors: *Ammonia, *Volatility, *Hydrogen ion concentration, *Nitrogen, *Soils, *Sampling Denitrification, Farm wastes, Cattle, Feed lots, Carbon dioxide, Lime, Chemical properties, Fertilizers, Texas.
Identifiers: *Nitrogen transfomations, *pH, Tabor loamy fine sand, Carbonates.

A study was conducted using 18 soil columns to study ammonia volatilization and nitrogen transformations in soils receiving manure applications. Three of both limed (pH=12.0) and unlimed (pH=7.5) soil columns were evaluated after 30, 60, and 90 day treatments. More NH3 was evolved from the limed soils than from the unlimed soils. CO2 production was greater in unlimed soils. Final chemical analyses of soils revealed 10% and 20% losses in nitrogen from limed and unlimed soils respectively. These nitrogen losses were greater in the upper 30 cm. of the soil columns. Nitrogen losses from the limed columns were believed to be by nitrification and then denitrification. (Frantz-East Central).

1323 - A1, B1, F4

DAIRY HOUSING, NATIONAL DAIRY HOUSING CONFERENCE

Dairy Housing, National Dairy Housing Conference, Michigan State University, East Lansing, February 6-8, 1973, 469 p. 53 fig, 17 tab, 69 ref.

Descriptors: *Dairy industry, *Farm wastes, *Waste treatment, *Waste disposal, *Waste storage, *Environmental control, Legal aspects, Regulation, Air pollution, Water pollution, Economics.

Identifiers: *Free-stall housing, *Stall barns, Composting.
The National Dairy Housing Conference was an attempt to bring appropriate disciplines together to focus on the subject of dairy housing. Emphasis was on practical information for use by people in the field. Subjects included: free-stall housing, stall barns, herd health, environmental control, codes and regulations, milking systems planning, feeding systems, calf and young stock housing, milk house and milking parlor wastes, and manure management. (Janssen-East Central).

1324 - A5, B2, C5

CONVENTIONAL STALL BARNS WITH GUTTER GRATES AND LIQUID MANURE STORAGE

Agricultural Engineering Department, Minnesota University.
D. W. Bates.
Dairy Housing, National Dairy Housing Conference, Michigan State University, East Lansing, February 6-8, 1973, p. 98-107. 5 fig, 5 ref.

Descriptors: *Waste storage, *Liquid wastes, *Dairy industry, Cattle, Ventilation, Odor, Minnesota.
Identifiers: *Stall barns, **Manure tanks, Gutter grates.

Dairymen in cold climates have begun to employ manure storage tanks 9 months of the year. For the new dairy barn, a practical place to store manure is directly beneath the barn for removal as a liquid. With this method, the wall of the manure tank can act as a foundation for the barn and the floor of the barn can serve as the cover for the manure tank. By using gutters with grated bottoms, manure and urine drop directly into the storage pits, and the need for a gutter cleaner is eliminated. A garden rake may be used to work through manure that hangs on the grates. Typical construction details for such a system are outlined. Already existing dairy barns usually have to employ an external manure tank. The gutter cleaner elevator can be modified so manure will drop directly into the tank. Careful planning and management is essential for the success of either system. (Janssen-East Central).

1325 - A5, B1

SUMMER ENVIRONMENTAL MODIFICATION SYSTEMS FOR DAIRY COW HOUSING IN THE UNITED STATES

Agricultural Research Service, United States Department of Agriculture, Columbia, Missouri.
LeRoy Hahn, D. D. Osburn, and J. D, McQuigg.
Dairy Housing, National Dairy Housing Conference, Michigan State University, East Lansing, February 6-8, 1973, p. 134-141. 3 fig, 12 ref.

Descriptors: *Dairy industry, *Environmental control, Productivity, United States, Odor, Moisture, Ammonia, Air Conditioning, Costs.
Identifiers: *Summer environmental modification systems, Housing, Evaporating cooling, Partial Air Conditioning.

Protective shelters for dairy cows are adequate in many areas of the United States, considering the normal levels of milk production and the relatively small regions of adverse summer climates. However, for high-producing cows in hot-dry or hot-humid climates, milk-production losses which are a result of the direct influence of climatic factors can be a severe problem. Managers of dairy herds in such areas should consider adopting an environmental modification system for improved production. The form of modification adopted must be rationally selected; not all systems are profitable. The optimum environment for maximum production is not the economic optimum for current costs and returns. Of the alternative systems considered in this report, evaporative cooling appears to have the most potential for application in areas with hot summer climates. (Hahn-ARS, USDA).

1326 - A1, B1, C5, F1, F2

POTENTIAL ECONOMIC IMPACTS OF STATE POLLUTION CONTROL ON DAIRY FARMS

Agricultural Economic Department, Michigan State University.
L. J. Connor, and J. B. Johnson.
Dairy Housing, National Dairy Housing Conference, Michigan State University, East Lansing, February 6-8, 1973, p. 182-191. 1 tab, 4 ref.

Descriptors: *Economic impact, *Legal aspects, *Dairy industry, *Farm wastes, *Waste treatment, *Waste disposal, Water pollution, Air pollution, Feed lots, Cattle, Michigan.
Identifiers: *State pollution controls, State statutes.

Changes in livestock production and concern for the environment have resulted in enactment of varied state statutes concerning pollution problems associated with livestock production facilities and waste disposal areas. The impact of state legal controls varies according to the type of legal control enacted, herd size, housing-waste handling systems, and specific location variables. A Michigan study illustrates the varying impacts upon dairy farms that would accrue with specific herd size and housing-waste handling systems for each of three selected legal pollution controls. Individual dairy farmers are advised to exercise caution in making any expansion or adjustments in their businesses, and in evaluating any potential environmental problems in their farms. (Janssen-East Central).

1327 - B1, C5, D4

DESIGN OF MILKING CENTER WASTE MANAGEMENT SYSTEMS

Agricultural Engineering Department, Cornell University, Ithaca, New York.
R. T. Lorenzen, and R. W. Guest.
Dairy Housing, Natilonal Dairy Housing Conference, Michigan State University, East Lansing, February 6-8, 1973, p. 349-358. 2 fig, 1 tab, 11 ref.

Descriptors: *Dairy industry, *Design, *Farm wastes, *Waste treatment, *Waste disposal, *Waste storage, Lagoons, Biochemical oxygen demand, Septic tanks.
Identifiers: *Milking center, *Waste management systems, Aeration ponds, Effluent quantity, Settling tank.

Design data from several recent studies are applied to the collection, treatment, storage, and disposal systems for handling milking center wastes. Included are parameters for quantity, physical constituents, and biological degradation of milk room wastes, milking parlor wastes, and human wastes. Point source and composition of milking center effluent is outlined. Milking center effluent routing options are discussed. It is concluded that existing circumstances at the site must be that paramount consideration in selection of a waste handling option. (Janssen-East Central).

1328 - A1, B2, D4

LAGOON DISPOSAL OF DAIRY WASTES IN FLORIDA

Agricultural Engineering Department, Florida University.
Dairy Housing & National Dairy House Conference, Michigan State University, East Lansing, February 6-8, 1973, p. 359-370. 1 fig, 1 tab, 6 ref.

Descriptors: *Lagoon, *Farm wastes, *Waste disposal, *Waste storage, *Waste treatment, *Dairy industry, *Florida, Climates, Soil types, Water pollution, Odor, Sludge.
Identifiers: Sand trap, Anaerobic lagoon, Storage ponds, Dispersal field.

The dairy industry in Florida is characterized by large milking herds. The type of waste management systems used are influenced by the amount of labor and management input and by climate and soils of Florida. The most common waste management system used is the lagoon system, consisting of a sand trap, anaerobic lagoon, detention pond, and dispersal field. The dimensions, volumes, efficiency and maintenance requirements of each of the four major components of the lagoon systems are discussed. The Florida Department of Pollution Control has set guidelines for the use of lagoons in Florida and lagoon construction has accelerated in the state. The lagoon system is successful in Florida due to climatic and soil conditions but may not be successful in other states. Potential ground water pollution must be carefully considered. (Janssen-East Central).

1329 - B2, C5, D4

PROGRESS REPORT—AEROBIC AND ANAEROBIC LAGOONING OF DAIRY AND MILKING WASTES

Agricultural Engineering Department, Clemson University, Clemson, South Carolina.
C. L. Barth, H. P. Lynn, and W. L. Northern.
Dairy Housing, National Dairy Housing Conference, Michigan State University, East Lansing, February 6-8, 1973, p. 371-380. 5 fig, 5 tab, 6 ref.

Descriptors: *Lagoons, *Aerobic conditions, *Anaerobic conditions, *Dairy industry, *Farm wastes, *Waste treatment, Sludge, Algae.
Identifiers: *Dairy wastes, *Milking wastes, *Lagoon simulators, Volatile solids.

A progress report was made on the lagooning of dairy wastes. One of the objectives was to evaluate the feasibility of the no-dischrage, anaerobic lagoon as a treatment facility for all dairy production wastes in a warm climate. Results of various research reports are compared to results obtained through use of six lagoon simulators. Among the results were these: (1) Highest percent reductions of volatile solids were about 51% and 15% for the dairy manure wastes at the operating temperatures of 24.3°C and 11.5°C, respectively, (2) For the parlor wastes, maximum reduction percentages were about 63% and 10% at temperature levels of 24.6°C and 11.0°C. The increase of the higher over the lower operating temperature level approximates the rule of thumb that an increase of 10.°C in temperature doubles the biological activity rate, (3) No apparent difference existed in the rate of sludge buildup from the manure waste at the two operating temperatures, (4) Using the range of .135 to .18 ft. 3 of sludge per lb. of V.S. added and the figure of 7.9 lb. V. S./100 lb. cow/day would produce 390-520 ft. 3 of sludge per year, (5) It was found that each cow produced six gallons of parlor waste, thus producing .025 to .05 ft. 3 of sludge per day of parlor wastes. (Janssen-East Central),

1330 - B2, E2

IRRIGATION DISPOSAL OF MILKING CENTER WASTES

Agricultural Engineering Department, Missouri University, Columbia.
R. E. Phillips, M. R. Peterson, and R. M. George.
Dairy Housing, National Dairy Housing Conference, Michigan State University, East Lansing, February 6-8, 1973, p. 381-388. 2 fig, 2 tab, 7 ref.

Descriptors: *Irrigation, *Waste treatment, *Waste storage, *Waste disposal, *Farm wastes, *Dairy industry, *Lagoons, Aerobic conditions, Anaerobic conditions, Water pollution.
Identifiers: *Milking Center, *Soil plant filter, Volatile solids.

The use of irrigation systems to distribute milking center wastes to a soil-plant filter is an effective method of both waste disposal and pollution prevention. An anaerobic lagoon is recommended for collecting and storing milking center wastes. The type of irrigation system selected should be based on size operation, soil type, terrain encountered on the soil plant filter, available capital, and the manager's preference. The four types of surface irrigation suited to disposal of liquid wastes are: controlled flooding, furrow irrigation, border irrigation, and corrugation irrigation. (Janssen-East Central).

1331 - B2, B3

SOLID MANURE HANDLING FOR DAIRY CATTLE

Agricultural Engineering Department, Wisconsin University.
J. C. Converse, C. O. Cramer, T. J. Brevik, and O. H. Tenpas.
Dairy Housing, National Dairy Housing Conference, Michigan State University, East Lansing, February 6-8, 1973, p. 389-397. 5 fig, 5 ref.

Descriptors: *Dairy industry, *Cattle, *Solid wastes, *Liquid wastes, *Farm wastes, Operations research management, Waste storage.
Identifiers: Manure stacking, Bunker, Manure.

Solid manure research activities, management techniques, and storage problems are discussed. Two types of storage facilities are described. One is a bunker type storage structure for solids with a detention pond for liquids. The other system consists of two storage units serving 28 and 26 cows each. One is a pivoting elevator which is an extension of the barn cleaner while the other one is a thrower which places the manure in a windrow. The liquids flow into detention ponds. Several field type units using low cost limestone or shale bases are also being investigated. Fifteen recommendations and conclusions were drawn from this research. (Janssen-East Central).

1332 - A2, B1, D1

MANAGING BARNYARD RUNOFF FOR DAIRY CATTLE

Agricultural Engineering Department, Wisconsin University.
J. D. Converse, C. O. Cramer, T. J. Beevik, C. B. Gilbertson, G. H. Tenpas, and D. A. Schlough.
Dairy Housing, National Dairy Housing Conference, Michigan State University, East Lansing, February 6-8, 1973, p. 398-403. 2 fig, 1 tab, 4 ref.

Descriptors: *Water storage, *Agricultural runoff, *Dairy industry, *Waste disposal, Cattle, Irrigation, Water pollution sources.
Identifiers: *Waste Management.

Runoff control facilities, installed at two Wisconsin farms, are described and the chemical and physical characteristics of the runoff are given. The three requirements for control of runoff are separation of solids, storage of runoff liquids, and a disposal area. Each of these farms utilized these requirements in similar manner, constructing a settling terrace, a settling basin, a porous dam, and a detention pond, Among conclusions and recommendations are the following: (1) Flow velocities in the terrace or basin should be less than 1 fps. with detention times greater than 1 hour. (2) The slope of the setling terrace must be essentially level to avoid a build-up of solids near the porous dam. (3) Removal of solids from the settling terrace soon after accumulation is necessary to maintain storage capacity for the next storm. (4) In Wisconsin, the capacity of the detention pond should be equal to 8 to 10 inches of runoff from the watershed because of winter precipitation. (5) Detention ponds should be located in impermeable soil so as to eliminate ground water pollution. (6) Detention pond slopes should be 3:1 to 6:1 with an 8 foot wide top on the berm. Ponds should be fenced for safety. (7) Just before freeze up in late fall, the liquid level in the detention pond should be lowered to provide storage for winter and early spring runoff. (Janssen-East Central).

1333 - B2, D2, E2

AGITATING, PUMPING, AND INJECTING LIQUID MANURE

Director of Engineering, Starling, Inc., Harvard, Illinois.
A. K. Gillette.
Dairy Housing, National Dairy Housing Conference, Michigan State University, East Lansing, February 6-8, 1973, p. 404-408.

Descriptors: *Waste disposal, *Liquid wastes, *Farm wastes, *Pumping, Waste storage.
Identifiers: *Agitating, *Manure, *Soil injection, Plowing, Disking, Agitator pump, Chopper pump, Vacuum pump, Centrifugal pump, Auger.

Manure collected and stored in pits or tanks usually must be agitated prior to emptying or pumping. This may be accomplished by use of an agitator pump, a "chopper" pump, or a vacuum type tank spreader. Each of these methods usually transports the liquid manure into a tank spreader used for depositing the manure onto the land's surface. The use of centrifugal pumps and augers is discussed but not encouraged. Soil injectors may be attached to the tank spreader, discharging the liquid manure into furrows and covering them up. Plowing and disking are discussed as means for obtaining similar results. Soil injection best achieves elimination of odor and runoff pollution. "Plowdown" rates next and disking rates last. All these methods are better than surface spreading for prevention of runoff and for odor control. (Janssen-East Central).

1334 - A5, B2, D2

MIXING AND HANDLING OF LIQUID DAIRY CATTLE MANURE

School of Engineering, Guelph University, Guelph, Ontario.
J. Pos, and H. E. Bellman.
Dairy Housing, National Dairy Housing Conference, Michigan State University, East Lansing, Febuary 6-8, 1973, p. 400-418. 1 tab.

Descriptors: *Dairy industry, *Farm wastes, *Waste storage, *Aerobic treatment, *Liquid wastes, Nitrogen, Chemical oxygen demand, Biochemical oxygen demand, Mixing, Handling, Slurries, Odor, Ontario.
Identifiers: Manure pump, Agitation, Total solids,

A largely unsuccessful attempt was made in Ontario to evaluate several methods of agitating large quantities of liquid dairy manure and to investigate several possibilities of aerobic treatment to control odours in storage. The basic plan was to use 4 pipelines to each of 2 storage tanks; 3 for pumping manure into the bottom of each tank and a return line to the sump. Stones and wood shavings got into the system creating blockage problems. Another time, a four inch plastic pipe burst emptying the liquid manure into the barn and into a highway ditch. During the winter the agitator pump froze up. Data recorded December, 1972—January, 1973 revealed daily production of diluted manure for 104 dairy cows to be 225 cu. ft. of manure slurry and 108 cu. ft. wash water from the milk room and milking parlour. Eventually the amount of wash water was reduced, but the total diluted manure production of 3.19 cu. ft., per cow still exceeded the design specifications of 2 cu. ft. per cow. Analyses during this time for NH4, Org. N, Total N, BOD, and COD were made. In January of 1973, the tank had 20,474 cu. ft. of manure with a 4-inch thickness of frozen manure on the surface. On the basis of total solids and content, it appeared that a reasonable mix of suspended solids below the frozen crust was obtained after 30 minutes of mixing. Further observations and analyses are continuing to be made. (Janssen-East Central).

1335 - B2, D2

FLUSHING SYSTEMS FOR FREE-STALL DAIRY BARNS

Agricultural Engineering Department, Ohio State University.
R. K. White, and R. M. Porter.
Dairy Housing, National Dairy Housing Conference, Michigan State University, East Lansing, February 6-8, 1973, p. 419-428. 7 fig, 3 tab.

Descriptors: *Farm wastes, *Dairy industry, Automation, Chemical oxygen demand, Biochemical oxygen demand.
Identifiers: *Flushing systems, Free-stall dairy barns, Total solids, Volatile solids.

A new dairy science center was installed at the College of Agriculture at the Ohio State University with a flushing system for manure handling. A description of the facility is given. Two nine hundred gallon tanks with vertical sluice gates were used to discharge the flushing water. Peanut hulls were substituted for straw as bedding to allow the manure slurry to be discharged into the Columbus sewer system. Characteristics of the manure slurry, estimated daily water use, and manure output are tabulated. The flushing system will allow automation of a dairy facility and will reduce labor costs. (Janssen-East Central).

1336 - A4, D2, D4, E3

LIQUID COMPOSTING OF DAIRY COW WASTE

Director of Research, The DeLaval Separator Co., Poughkeepsie, NY.
Bernard Hoffman, and Lois S. Crauer.
Dairy Housing, National Diary Housing Conference, Michigan State University, East Lansing, February 6-8, 1973, p. 429-440. 4 fig.

Descriptors: *Farm wastes, *Dairy industry, *Cattle, *Waste treatment, *Waste disposal, *Wastewater treatment, Water pollution, Aerobic bacteria, Thermophilic, Ammonia, Biochemical oxygen demand, Chemical oxygen demand.
Identifiers: *Composting, *Liquid wastes, *Licom System.

Surface water and groundwater can be contaminated by manure through runoff and infiltration. A liquid composting system (Licom), developed by The De Laval Separator Company, deodorizes, pasteurizes, and biologically decomposes dairy cattle wastes with the use of digestion tanks and bacteria. Several modes of Licom System operation are available. Effluent from Licom I is completely stabilized and pasteurized and can be stored for long periods isbefore returning it to the land. The Licom II is a continuous system and operates more efficiently than Licom I. Licom III is also a continuous system and offers a method of separating the liquid and solid waste for discharge of the liquid into surface waters. The Licom III method efficiently met the New York State standards for effluent released into surface waters. The dry residue from Licom III may be used as a soil conditioner or as bedding in the barns. (Janssen-East Central).

1337 - B3, D4

SOLID COMPOSTING OF DAIRY MANURE

Agricultural Research Service, United States Department of Agriculture.
G. B. Willson, and J. W. Hummel.
Dairy Housing, National Dairy Housing Conference, Michigan State University, East Lansing, February 6-8, 1973, p. 441-459. 12 fig, 2 tab, 9 ref.

Descriptors: *Dairy industry, *Farm wastes, Aeration, Moisture, Chemical oxygen demand, Aerobic bacteria, Nitrates, Ammonia, Permeability, Thermophilic bacteria.
Identifiers: *Compostiong, *Manure.

This paper is based on studies that were undertaken to develop design criteria for composting operations. Aeration data was obtained from tests in small bench composters, and in one-half ton capacity bins. These data were substantiated by the composting of dairy manure in a mechanized channel. It was determined that ideally the aeration rate would be varied during the process in the following sequence: 1. During the warmup stage of the process, aeration would be applied at increasing rates in the low part of the temperature limiting range. 2. When thermophilic temperature is reached, the aeration rate would be increased to the top of the temperature limiting range. If some drying is desirable, a higher aeration rate would be selected. 3. As the level of activity decreases, the rate of aeration would be reduced to prevent cooling. This operating procedure will keep temperatures up until desired degree of decomposition is reached. (Janssen-East Central).

1338 - B1, F2, F4

WASTE MANAGEMENT REGULATIONS AND PROPOSALS

Agricultural Pollution Control Research Program, Office of Research and Monitoring, United States Environmental Protection Agency, Washington, D. C.
W. C. LaVeille.
Dairy Housing, National Dairy Housing Conference, Michigan State University, East Lansing, February 6-8, 1973, p. 460-469.

Descriptors: *Federal Water Pollution Control Act, *Farm wastes, *Feed lots, *Regulation, *Legal aspects, Environmental control, Water pollution sources, Permits, Cattle, Hogs, Poultry.
Identifiers: *Waste management, Environmental Protection Agency.

The establishment, organization, and activities of the Environmental Protection Agency are discussed. The history of federal water pollution control is traced from the 1886 River and Harbor Act to the Federal Water Pollution Control Act of 1972. It is felt that this new law will bring a profound and far-reaching change to the system of pollution control because it (1) establishes effluent limitations, (2) establishes higher standards of pollution control, (3) creates a national permit program and (4) establishes tough penalties to enforce compliance. The most immediate concern of those involved in agricultural production activities is how the permit program will affect them. Proposed rulemaking excludes discharges from agricultural and silvicultural activities from NPDES (National Pollutant Discharge Elimination System) requirements with the exception of large feedlots, certain types of hatcheries and fish farms, and return flow from some medium- and large-sized irrigation systems. Although owners and operators of the excluded point sources are not required to obtain an NPDES permit, they must comply with the other requirements of the Act, including any applicable effluent guidelines, standards of performence, toxic effluent standards or prohibitions; or pretreatment standards, (Janssen-East Central).

1339 - B1

CLIMATE AND THE SELECTION OF A BEEF HOUSING AND WASTE MANAGEMENT SYSTEM

Agricultural Engineering Department, Oklahoma State University, Stillwater.
A. F. Butchbaker, G. W. A. Mahoney, and J. E. Garton.
Transactions of the ASAE, Vol. 16, No. 4, p. 734-739, July-Aug., 1973. 5 fig, 1 tab.

Descriptors: *Climate, *Climatic data, *Climatic zones, *Feed lots, Farm Wastes, Waste treatment, Waste disposal, Cattle, Temperature, Moisture.
Identifiers: *Beef housing, *Location, Climatological maps.

Location of a beef feedlot is influenced by factors related to economics, local topography, nearness to residential areas, soil type, roads, microclimate, streams or lakes, area for waste disposal, and climatic conditions. This report is concerned with climate, one of the major considerations in determining a feedlot location because climate influences both capital investment and operating cost. Some of the climatic factors affecting waste management systems are those that also affect animal performance. These include temperature, humidity, solar radiation, wind, evaporation, precipitation, sunshine, and storms. These topics are explained. Beef housing climatic zones were developed by using air temperature, evaporation and precipitation. Another method of classifying beef housing and waste management systems is to develop a climatological map utilizing mean annual air temperature and moisture deficit. These climatological maps may be used to select a general waste management system. The waste management systems in the various climatological areas should be considered as those that are optimum for that area. (Cartmell-East Central).

1340 - A4, A5, B1, E1, F2

FEEDLOT WASTE MANAGEMENT: PROGRESS AND OUTLOOK

Agricultural engineer—animal waste management, Texas Agricultural Extension Service, Department of Agricultural Engineering, Texas A & M University.
J. M. Sweeten.
Texas Agricultural Progress, Vol. 19, No. 2, p. 18-19, Spring, 1973.

Descriptors: *Waste disposal, *Waste treatment, *Feed lots, *Pollution abatement, *Farm wastes, *Water pollution control, Solid wastes, Odor, Recycling, Irrigation, Fertilization, Rainfall, Solid wastes, Regulation.
Identifiers: *Waste management, refeeding, Pyrolysis, Odor intensities, Climatic variables.

Water pollution abatement was an environmental pollution problem for Texas cattle feeders. The Texas Water Quality Board restricts seepage to ground water and forbids discharges of feedlot runoff from rainfall. To prevent this seepage, diversion channels, retention ponds and irrigation systems are constructed near playa lakes. Texas standards for feedlots may serve as a model for forthcoming federal water pollution limitations. Another environmental problem is the large number of manure stockpiles. These wastes are being disposed of by farmers interested in increased profits from crop production. Research of the USDA at Bushland, Texas, shows that 10-ton-per-acre applications of feedlot manure matched nitrogen-phosphorous-potassium fertilization in production of grain sorghum. Test results indicate that feedlot manure can be safely and economically applied at 10 tons per acre per year under many soil and cropping conditions. Besides land disposal, recycling methods involve converting animal wastes into animal feed, fuels, building materials and other products. Solutions to feedlot odor problems need to be developed. Odor intensities, climatic variables, and waste management practices need to be understood before this can be done. When these pollution problems have been solved, feedlot waste management may involve economic alternatives rather than being primarily involved with pollution abatement. (Cameron-East Central).

1341 - B2, E2
NO ODOR AND NO POLLUTION
Soil Conservation Service, Hondo, Texas.
E. L. Abbott.
Soil Conservation, Vol. 39, No. 2, p. 8-9, September, 1073. 2 fig.

Descriptors: *Odor, *Recycling, *Farm wastes, *Feed lots, Irrigation, Air pollution, Water pollution, Texas.
Identifiers: *Feeding pens, *Slatted floor, Bermudagrass, Detention pit, Concrete tile line.

Near Devine, Texas, is a cattle feedlot which has a total recycling system for feedlot wastes. Feeding pens, designed so that all waste material on the floor drains downward, are all concrete with half the area of each pen under roof. Floors are flushed at regular intervals causing waste material to drain into a concrete tile line which carries it into a two-compartment concrete detention pit. There, quantities of clear water are added to the slurry. The liquid is lifted by a pump and flows under pressure through an underground pipeline to pivoting irrigation booms which sprinkle the "brown water" on the soil of mowed fields. A second concrete pit provides an overflow catch basin which assures no escape of waste material. Coastal bermudagrass is the best grass for this type of fertilizer-irrigation. The grass goes through a dehydration process before it is pelleted to be fed to the cattle. This type of feedlot has been designed and tested to be sure that pollution was a thing of the past. This particular feedlot has won many awards for its success. (Cameron-East Central).

1342 - B2, C5, D2, E3
CONCENTRATION OF PROTEINACEOUS SOLIDS FROM AERATED SWINE MANURE
University of Briitsh Columbia, Canada.
Lloyd W. J. Holmes.
MS Thesis, Agricultural Engineering Department, University of Illinois, 1971, 92 p.

Descriptors: *Farm wastes, *Hogs, *Aeration, *Oxidation lagoons, *Recycling, Suspended solids, Sieves, Centrifugation, Amino acids, Proteins.
Identifiers: *Manure, *Refeeding, Proteinaceous solids, Oxidation ditch mixed liquor.

This study was undertaken to determine what fraction of swine oxidation ditch mixed-liquor (ODML) possessed a refeeding potential; and to determine the best method of recovery and concentration of this fraction. Swine ODML samples were passed through a series of sieves, ranging in size from 20-to- 200-mesh. The solids retained on each screen were dried, weighed and analyzed for kjeldahl nitrogen. It was apparent that the highest crude protein and largest weight fraction was contained in the smallest size fraction, those suspended solids passing through a 200-mesh sieve. Preliminary investigations indicated that centrifugation was a promising method of ODML S.S. concentration. Centrifuging trials were run on screened ODML to determine the optimum feed rate and G force required to produce a concentrated cake of approximately 6-8 percent solids dry weight basis (dwb). Increasing the feed S.S. concentration had the effect of decreasing S.S. recovery. Centrifuged samples of swine ODML were found to contain a greater percentage of essential amino acids than corn. Centrifugation has been shown to be a feasible method of concentrating the amino acid-rich portion of swine ODML. Liquid volume reduction on the order of 85 percent can be achieved by increasing the solids content of ODML from 1.2 to 8 percent. This solids concentration is sufficient to enable researchers to refeed a substantial amount of swine ODML S.S. without including the bulk of the carrier liquid in the feed. (Cartmell-East Central).

1343 - B3, C5, D2, E3
CATTLE MANURE TO PIPELINE GAS
Pittsburgh Energy Research Center, Bureau of Mines, Pittsburgh, Pennsylvania.
Herman F. Feldmann, K. Kiang, C. Y. Wen, and P. M. Yavorsky.
Mechanical Engineering, October, 1973, p. 36-41. 1 fig, 4 tab, 6 ref.

Descriptors: *Cattle, *Farm wastes, *Recycling, solid wastes, Organic wastes, Methane, Moisture, Economics.
Identifiers: *Manure, *Gas, Hydrogasification, Hydrant process.

This is an experimental study in which dried cow manure was reacted with hydrogen under a variety of conditions to determine the yield of hydrogasificatiaon products. Demonstrated is the feasibility of converting manure to pipeline gas on a large scale, For reasonably large plants, the pipeline gas from this process is is cheaper than from any other source except natural gas. The primary reason for these favorable economics is that manure is assumed to be free. Because of the important effect of plant size on gas price, more detailed estimates will be made of smaller plants to determine the minimum feasible plant size and thereby determine the areas of the country where application of this technology would be economically feasible. (Cartmell-East Central).

1344 - A8
BACTERIAL POLLUTION INDICATORS IN THE INTESTINAL TRACT OF FRESHWATER FISH
Microbiology Section, Basic and Applied Science Branch, Division of Water Supply and Pollution Control, Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio.
Applied Microbiology, Vol. 14, No. 3, p. 429-437, May, 1966. 2 fig., 7 tab, 19 ref.

Descriptors: **Bacteria, *Freshwater Fish, Coliform, Sampling, Temperature.
Identifiers: *Bacterial pollution indicators, *Intestinal tract, Fecal coliforms, Streptococci, Little Miami River.

A study was made of the occurence, distribution, and persistence of coliforms, fecal coliforms, and fecal streptococci in the intestinal tract of freshwater fish. A total of 132 fish representing 14 different spcies were used in various phases of these experiments. Examination of the intestinal contents of 73 fish from moderately polluted sections of the Little Miami River indicated that fecal coliform densities were lowest in bluegills and highest in catfish. Levels of fecal streptococci for these two species were 220 and 240,000 per gram, respectively. The occurrence of fecal coliforms in fish caught in this stream reflected the warm-blooded-animal-pollution level of the water. All fish used in this phase of the study were caught during July, August, and September when the water temperatures were between 13 and 18 C. The fate of fecal coliforms and streptococcus faecalis in the fish intestine indicated that these organisms can probably survive and multiply when fish and water temperatures are 20 C or higher, but only when the organisms are retained in the gut for periods beyond 24 hr. (Cartmell-East Central),

1345 - B1, D2
ARIZONA OPERATORS QUESTION FLUME CONCEPT
Editor of BEEF.
Paul D. Andre.
BEEF, Vol. 10, No. 6, p. 44, February, 1974. 2 fig.

Descriptors: *Waste disposal, *Flumes, *Feed lots, *Cattle, *Farm wastes, Design, Ammonia, Costs.
Identifiers: *Waste management, Slotted floors, Flushing.

This was a test of a flume structure in Arizona. The test building was 24 feet wide and 400 feet long with two 12 inch flumes on 12 foot centers. Various textures were used on the floor surface, and the slope of the flumes ranged from ½ inch to 1 inch per foot. During the feeding test, 80 head of cattle were placed in each pen. An equal number of comparable cattle were put in an adjacent slotted floor building and given the same amount of space per head. Rations were identical. The following problems arose with use of the flume structure: (1) insufficent cleaning, (2) difficulty of the men in maintaining their balance, (3) the need for daily flushing, (4) the need for the cattle to have shade, (5) lack of ammonia control, and (6) the difficulty of cattle in getting their footing. There was no significant difference in the performance of the groups of cattle and no significant difference in the operating costs of the two operations. (Cartmell-East Central),

1346 - B2, D1
FEEDLOTS POINT SOURCE CATEGORY: EFFLUENT GUIDELINES AND STANDARDS PART II.
Environmental Protection Agency.
Federal Register, Vol. 39, No. 32, February 14, 1974, p. 5706-5707.

Descriptors: *Feed lots, *Livestock, *Poultry, *Hogs, *Effluent,, *Farm wastes, Technology, Economics, Dairy industry.
Identitfiers: *Standards, Open lot, Housed lot, Stall barn, Free stall barn, Milkroom, Milking center, Process waste water, Process generated waste water.

Environmental Protection Agency guidelines and standards involving feedlots and waste production are presented. The terms feedlot, process waste water, process generated waste water, 10 year —24 hour rainfall event, 25 year—24 hour rainfall event, open lot, housed lot, stall barn, free stall barn, milkroom, and milking center are defined. Effluent limitations guidelines representing the degree of effluent reduction attainable by the application of the best practicable control technology currently available are presented. Also effluent limitations guidelines representing the degree of effluent reduction attainable by the application of the best available technology economically achievable is discussed. Pretreatment standards for existing sources, standards for performance for new sources, and pretreatment standards for new sources of waste are also considered. (Russell-East Central).

1347 - A8

THE BACTERIAL FLORA OF THE ATLANTIC SALMON (SALMO SALAR L.) IN RELATION TO ITS ENVIRONMENT

Department of Trade and Industry, Torry Research Station, 135 Abbey Road, Torry, Aberdeen, Scotland.
R. W. Horsley.
The Journal of Applied Bacteriology, Vol. 36, No. 3, p. 377-386, September, 1973. 4 fig, 3 tab, 29 ref.

Descriptors: *Salmon, *Environment, Sampling.
Identifiers: *Bacterial flora, Skin, Gills.

The aerobic flora of the skin of 56 Atlantic salmon from coastal, estuarine and river water was analyzed quantitatively; 50 skin and 33 gill samples were analyzed qualitatively. The water at each sampling station was also analyzed. The principal genera on the skin and gills were Moraxella, Flavobacterium, Cyptophage and Pseudomonas; members of Acinetobacter, Bacillius, Aeromonas, Vibrio, the Entrobacteriaceae, Micrococcaeae and some coryneforms were also present. These analyses indicated that the flora of fish is a reflection of their environment. (Cartmell-East Central).

1348 - B3, C5, D2, E3

BRICKS ARE BEING FORMED FROM MANURE AND GLASS

Hoard's Dairyman, Vol. 119, No. 1, p. 35, January 10, 1974.

Descriptors: *Farm wastes, *Cattle, *Recycling, *Waste disposal, Dairy industry.
Identifiers: *Glass, *Bricks, *Manure, *Building materials.

Dr. John D. Mackenzie, Los Angeles engineering professor, has perhaps found an answer to the problem of animal waste disposal. He has perfected building products, such as bricks, tiles, wall core materials, and garden stones, from a mixture of dried cow manure and broken glass bottles blended together in a pressure cooker. The building products are stronger and lighter than any now on the market. They are fireproof, odorless, noise and heat insulators, and can be drilled, sawed, painted and glued easily. This inexpensive process answers two problems: (1) environmental concerns on the farm, and (2) badly needed construction materials. It also utilizes the untold amounts of disposable glass containers. The University of California has applied for patents covering the main process. (Cameron-East Central).

1349 - A2, B2, B3, F3

ANIMAL FEEDLOT WASTE RESEARCH PROGRAM

Treatment and Control Research Program, Robert S. Kerr Research Center, Environmental Protection Agency, Ada, Oklahoma.
Jack L. Witherow, Marion R. Scalf, and Lynn R. Shuyler.
Unpublished paper, April, 1971. 21 p. 1 fig, 9 ref.

Descriptors: *Confinement pens, *Water pollution sources, *Farm wastes, Surface runoff, slurries, livestock, research and development, projects, feed lots.
Identifiers: Manure.

The growth and cause of water pollution from animal feedlot waste is described. The research responsibilities of the Federal Water Pollution Control Administration are met by inhouse, grant and contract projects. Priority for research projects is given in terms of immediate and long range research needs. A list of immediate research needs is grouped into specific characterization projects and specific soil treatment projects. The long range research need for prevention of water pollution is described for liquid runoff, solid manure, and slurry systems. Seven specific project areas are presented in a list. One figure presents pollution control pathways for the three forms of animal wastes. (FWPCA Abstract).

1350 - B2, D1

CONFINEMENT SYSTEM OFFERS NEW SOLUTIONS TO OLD PROBLEMS

Staff editor of FEEDLOT MANAGEMENT.
Tom Zurowski.
FEEDLOT MANAGEMENT, Vol. 15, No. 9, p. 44, 48, September, 1973. 2 fig.

Descriptors: *Farm wastes, *Feed lots, *Confinement pens, *Livestock, *Farm management, *Waste storage, Waste treatment, Costs.
Identifiers: Concrete holding ponds, Barn cleaners, Hot water heating system, Slatted floors, Pollution.

Cliff Nybo and John Nilander built a workable confinement system in Northfield, Minnesota. The system is composed of a confinement barn, a concrete holding pond, barn cleaners, and a special hot water heating system in the floor of the unit which helps make the entire system functional. The barn is divided into 8 pens. Each pen has a capacity for 75 animals with approximately 20 sq. ft. of space per animal. The floor is partially slatted. A steeply sloped pit is located beneath the slatted area. Barn cleaners are at the bottom of the pit. The cleaners dump the manure into a concrete holding pond. To prevent manure freeze up, hot water heating lines are placed beneath the solid portions of the floor. The system, not including cleaners, feed storage, feeders, and waterers, cost $74,000. The advantages of this system are that it is pollution proof and it is easy to operate. Because it has zero discharge from its pens, this operation will comply when any new pollution control regulations are developed. (Cameron-East Central).

1351 - B1, F3, F4

SYMPOSIUM: PROCESSING AGRICULTURAL AND MUNICIPAL WASTES

G. E. Inglett, editor.
Symposium: Processing Agricultural and Municipal Wastes, New York, New York, August 27-28, 1972, 221 p. 90 fig, 66 tab, 301 ref.

Descriptors: *Research aand development, *Waste treatment, *Recycling, *Waste disposal, *Farm wastes, Municipal wastes, Industrial wastes, Water pollution, Air pollution, Soil contamination, Environmental control.

To meet the needs of the increasing world population, cities become larger, industries expand, and agricultural operations become larger and more automated. All of these necessary increases in production result in a simultaneous increase in waste production and the problem of adequately dealing with this waste broadens. The papers of this symposium indicate that this problem is being met head-on, and technology is being devised, tested, and re-examined to deal with the waste problem. Advances in recycling animal, poultry, and industrial wastes have been recorded, but much more has been shown to be necessary. Various methods for utilization of these by-products have been outlined and offer very promising results. With the beginnings offered at this symposium, there is little doubt that the challenge of progress and increased production in our society can be dealt with efficiently and economically. (Russell-East Central),

1352 - F3, F4

THE CHALLENGE OF WASTE UTILIZATION

G. E. Inglett.
Symposium: Processing Agricultural and Municipal Wastes, New York, New York, August 27-28, 1972, p. 1-5. 3 tab, 8 ref.

Descriptors: *Farm wastes, *Municipal wastes, *Livestock, *Waste treatment, *Waste disposal, Agricultural wastes, Industrial wastes, Technology, Environmental control.
Identifiers: *Waste management *Processing, *Waste utilization, Meat consumption, Composting.

Large concentrations of people, animals, and manufactured goods create waste problems. In 1965, 575 billion pounds of solid waste were produced for disposal. Of this total, industrial waste accounted for 229 billion pounds. This leaves 60% of the total waste production to come from agricultural waste. Concentration of animal waste is highly dependent on the present trends of automation and centralization. In cattle, swine, dairy herds, and poultry, feedlots are becoming larger and fewer, thus causing greater waste problems. Increasing consumption of meat with concomitant population growth can predictably bring more agricultural waste. For each pound of beef produced, 25 pounds of manure are produced. Thus, by 1980, 470 million tons of cattle manure will be produced for the estimated 235 million beef consumers in the United States. There is an immediate need for more technology for developing systems for waste management and utilization. Some of the proposed processes and related technology in this symposium may fill this need. (Russel-East Central).

1353 - E, F1, F3

ECONOMIC ISSUES IN MANAGEMENT AND UTILIZATION OF WASTE

Alden C. Manchester, and J. G. Vertrees.
Symposium: Processing Agricultural and Municipal Wastes, New York, New York, August 27-28 1972, p. 6-12. 6 ref.

Descriptors: *Economic, *Waste treatment, *Recycling, Poultry, Livestock.
Identifiers: *Waste management, *Waste utilization, Public policy, Government cost-sharing.

There is no universal solution to waste management problems. Alternative waste management methods exist for most firms, creating a need for economic analysis to determine the least-cost solution. The economic choice is between waste treatment and waste utilization. Utilization offers more long term promise; but before launching large projects, an analysis of waste utilization should be undertaken. In determining economic feasibility of utilization, three factors should be considered: (1) the market potential of waste utilization products; (2) the cost of such a process; and (3) the cost of waste management alternatives. The potential for increased utilization of waste is dependent on public policy toward utilization and on equity. Government cost-sharing may stimulate industries into using wastes, and even without significant aid or price change, many firms will utilize waste from their operations as a least-cost means of waste management when the costs of alternatives are evaluated. (Russell-East Central).

1354 - D1, E3, E4

PROCESSING ANIMAL WASTES FOR FEED AND INDUSTRIAL PRODUCTS

J, H. Sloneker, R. W. Jones, H. L. Griffin, K. Eskins, B. L. Bucher aand G. E. Inglett.
Symposium: Processing Agricultural and Municipal Waste, New York, New York, August 27-28, 1972, p. 13-28. 1 fig, 8 tab, 20 ref.

Descriptors: *Farm wastes, *Recycling, *Feeds, *Waste treatment, *Waste disposal, Nitrogen, Amino acids, Fermentation, Organic matter, Enzymes, Proteins.
Identifiers: *Processing, *Feed products, *Industrial products, Feedlot waste fractionation, Hardboard.

Reprocessing animal waste offers promising possibilities for elimination of a huge waste management problem. The average feeder steer generates 2.2 pounds of protein per day. If processed, a feed of manure has a value comparable to soybean meal and is worth about $20 per ton more than the cost of recovery. By a simple screening process, approximately 70% of the total nitrogen can be recovered from feedlot waste as a potential feed fraction containing 35-40% protein and representing approximately 40% of the total waste solids. The remaining bulky fiber fraction can be converted into a cheap, nonodorous ingredient for fiberboard-like products. Alternatively the fiber fraction and solubles can be recombined and used as a fermentation substrate for the cellulolytic fungus, T. viride. Studies with whole manure and the fibrous fraction indicate that more than 25% of the organic matter is digested by the fungus with complete retention of the nitrogen. These data illustrate that, potentially, T, viride enzymes, as an additive, can increase the digestibility and metabolizable energy of feeds. (Russell-East Central).

1355 - D4, E3, E4, F1

PROCESSING ANIMAL WASTE BY ANAEROBIC FERMENTATION

W. B. Coe, and M. Turk.
Symposium: Processing Agricultural and Municpal Wastes, New York, New York, August 27-28, 1972, p. 29-37. 1 fig. 1 tab.

Descriptors: *Recycling, *Farm wastes, *Fermentation, *Anaerobic conditions, Aerobic conditions, Waste treatment, Feed lots, Chemical analysis, Economics, Ammonia, Cattle.
Identifiers: *Processing, Refeeding.

Wastes must be recycled into products which can be used by the producer of these wastes. The recycling must be conducted in a non-polluting and profitable manner. The most desirable recyling product is a feed ingredient. The two major systems for degradation of manure utilize microbial conversion and consist of aerobic processes. Recent efforts have been directed toward aerobic techniques, but these processes have proved to be costly. The anaerobic process is technically and economically the most attractive method of recycling animal wastes. This process produces two products (a feed ingredient and a fuel in the form of methane) useful to the animal feeder. It accepts all the wastes produced without pollutional discharges and is potentially profitable, The anaerobic process requires two-thirds the capital investment and one-half the annual operating expense of the aerobic process. (Russell-East Central).

1356 - D2, D3, F1

AGRICULTURAL CELLULOSIC WASTES FOR FEED

Terry Klopfenstein, and Walter Kaers.
Symposium: Processing Agricultural and Municpal Wastes, New York, New York, August 27-28, 1972, pp. 38-54. 13 tab, 33 ref.

Descriptors: *Farm wastes, *Feeds, *Cellulose, *Waste treatment, Performance, Livestock, Silage, Inhibitors, Alkalinity.
Identifiers: *Sodium hydroxide, Digestibility, Roughage.

Agricultural cellulose wastes such as crop residues, fecal matter, paper, wood by-products and similar materials represent a vast supply of poorly utilized energy. Ruminants possess a unique digestive system which enables them to partially utilize the carbohydrate fraction of these materials. There are two procedures for enhancement of cellulosic waste usage. The first is the addition of sodium hydroxide to low-quality roughage followed by ensiling. At the present time, this appears to have practical applications, although the mechanics of collecting these low quality roughages and addition of sodium hydroxide and water would appear to be the greatest problems. The second procedure utilizes high pressure and temperature treatment of forages. To be practical and economical, this procedure would require on operation where materials could be collected and treated at a large centrally located facility. However, with treatment of large quantities, the cost could probably be held within a practical range. (Russell-East Central).

1357 - D2, D3, E3, F1

NUTRITIVE EVALUATIONS OF ANIMAL MANURES

L. W. Smith,
Symposium: Processing Agricultural and Municipal Wastes, New York, New York, August 27-28, 1972, p. 55-74. 1 fig, 8 tab, 92 ref.

Descriptors: *Nutrients, *Farm wastes, *Recyling, *Feeds, Chemical properties, Nitrogen, Ruminants Fermentation, Cellulose.
Identifiers: *Waste utilization, Processing methods, Digestibility, Wastelage.

Three major factors influence chemical compositions of animal manures: (1) the species of animals; (2) the compositions of diets fed; and (3) the plane of nutrition. Feeding trials illustrate that poultry manure is high in nitrogen and is more advantageously utilized by ruminants than by other animals. Ruminants also have a lower digestibility of cell walls than do monogastric species. Thus, monogastric feces are clearly shown to be superior in nutritive value to ruminant feces, as indicated by the higher nitrogen and low cell wall content of higher digestibility. However, before manure can be utilized as a nutritive feed, economical processing methods must be developed. Several methods have been reported for using biological intermediates for recovery of protein from manure. Also rapid advances in physical, chemical, and fermentation technology will provide better methods for conversion of manures into products of high nutritive value for animal feeding. (Russell-East Central).

1358 - A1, B2, D2, D4

AUTOMATED RECYCLE SYSTEM FOR LIVESTOCK WASTE TREATMENT

E. P. Taiganides, and R. K. White,
Symposium: Processing Agricultural and Municpal Wastes, New York, New York, August 27-28, 1972, pp. 75-83. 10 fig.

Descriptors: *Recycling, *Farm wastes, *Waste treatment, *Livestock, *Automation, Oxidation lagoons Effluent, Foaming, Influent, Biochemical oxygen demand.
Identifiers: Water flushing, Sludge index.

In today's large confined swine facilities, the waste handling and treatment system is often the factor controlling the success of the operation. Certain criteria must be considered in order to evaluate the livestock waste system—namely, ecology, economics, esthetics, and technology. A five hundred pig swine unit was tested by treatment and recycling of the effluent. Automated flushing from the swine building worked extremely well. There was little odor in the confinement building and no odor in the waste facility. Foaming of the oxidation ditch was a problem but a foam-suppressing drum has been the most suitable method for controlling the foam. Over a ninety percent reduction in the biochemical oxygen demand of the influent to the oxidation ditch, as compared to the effluent for recycling, has been achieved. The use of a Sludge Index has been found to be a good parameter for monitoring the operation of the oxidation ditch. (Russell-East Central).

1359 - D3, E3

FUEL FROM AGRICULTURAL WASTES

Herbert R. Appell, and Ronald D. Miller.
Symposium: Processing Agricultural and Municpal Wastes, New York, New York, August 27-28, 1972, p. 84-92. 5 tab, 5 ref.

Descriptors: *Farm wastes, *Fuels, *Oil, *Waste treatment, Organic matter, Biodegradation Waste water reclamation, Cellulose, Catalysts, Carbohydrates.
Identifiers: Ash content, Carbon monoxide, Raw materials.

Recognition of the increasing severity of the solid wastes problem has resulted in an increased research effort to find uses for waste materials. The conversion of a variety of wastes having a high carbohydrate content, largely cellulose, to a heavy oil has been one proposed method. A mechanism for the conversion of carbohydrates to oil consists of the following steps: (1) reaction of sodium carbonate and water with carbon monoxide to yield sodium formate; (2) dehydration of vicinal hydroxy groups in a carbohydrate to an enol, followed by isomerization to a ketone; (3) reduction of the newly formed carboxyl group to the corresponding alcohol with formate ion and water; and (4) the hydroxyl ion then reacts with additional carbon monoxide to regenerate the formate ion. Although manures are in some respects a desirable feedstock for conversion to oil, the high ash content, and the malodorus aqueous effluent pose problems for further research. (Russell-East Central).

1360 - D2, E3

ENERGY FROM THE PYROLYSIS OF AGRICULTURAL WASTES

M. D. Schlesinger, W. S. Sanner, and D. E. Wolfson.
Symposium: Processing Agricultural and Municpal Wastes, New York, New York, August 27-28, 1972, p. 93-100. 1 fig. 3 tab 4 ref.

Descriptors: *Farm wastes, *Waste treatment, *Waste disposal, Volatility, Cattle, Energy.
Identifiers: *Pyrolysis, *Agricultural wastes, Wood waste, Crop wastes, High moisture feedstock.

Experiments were conducted on various agricultural wastes which involved pyrolysis, or the heating of a material to a high temperature in the absence of air. Materials that cannot be burned cleanly in incinerators can be converted to gases, oils, or solids that can be burned cleanly by known methods. Generally, wastes are not available on a year-round basis except in a limited number of circumstances. Crops are harvested at particular times of the year, and feedlots may vary in their population. Because of this irregularity, it seems important to convert wastes of different composition and quantity into a form that may approach compatability with industrial firing practices. Pyrolysis provides this conversion and is self-sufficient in energy requirements. Practically all the energy in the feeds is recovered in the products. (Russell-East Central).

1361 - B3, D4, E2

COMPOSTING AGRICULTURAL AND INDUSTRIAL ORGANIC WASTES

S. J. Toth.
Symposium: Processing Agricultural and Municipal Wastes, New York, New York, August 27-28 1972, pp. 172-182. 4 tab, 8 ref.

Descriptors: *Farm wastes, *Industrial wastes, Moisture content, Aeration, Nitrogen, Phosphorous, Potassium, Livestock, Poultry, Sewage sludge, Municipal wastes, Chemical properties, Physical properties.
Identifiers: *Composting, *Agricultural wastes, *Organic wastes, Organic residues, Cellophane wastes.

Composts, like plant residues and organic wastes, tend to produce changes in the physical and chemical properties of soils in which they are incorporated. One of the changes in physical properties is an increase in soil aggregation. Addition of composts to soils also adds to the nitrogen, phosphorus, and potash contents of the soils. Many factors such as moisture content, aeration, nitrogen, phosphorus, and potassium, affect composting rates. When composting is finished, the ideal compost has a dark brown color, 80% organic matter, a moisture level of 10-20%, a water holding capacity of 150-200%, an ash content of 10-20%, a nitrogen content of 2.5-3.5%, a phosphorus oxide and potassium oxide content of 1-1.5%, a pH of 5.5-6.5%, and a slightly musty odor. Composts not only consist of animal wastes, but also industrial wastes which are high in carbon or organic matter. Municipal garbage has been studied as a composting material, but these products have little agricultural value when spread on land. (Russell-East Central).

1362 - A1, C5, E2

POULTRY MANURE DISPOSAL BY PLOW-FURROW-COVER

The College of Agriculture and Environmental Science, Rutgers Univ.—the State University of New Jersey, New Brunswick, New Jersey 08903.

Descriptors: Agricultural machinery, *Deposition, *Organic wastes, Soils, fertilizers, *Wastes, *Waste disposal, *Pollution, Slurries, Poultry, Water pollution, Soil water, Contamination, Percolation, Equipment, Decomposition, Ground water, Salmonella, Test facilities, Recycling.
Identifiers: *Plow-Furrow-Cover technique, *Poultry manure, Solid waste disposal, Resource recovery, Fecal coliform, Suction lysimeters, Technicon Auto-Anlayser.

This study consisted of 4 years of research conducted to determine the feasibility of the Plow-Furrow-Cover (PFC) method of manure disposal. The purposes of the research included development of equipment and techniques for the disposal of poultry manure in soil, and measurement of the consequent chemical, physical, and biological changes. Various sections of the report described the development of equipment; effect upon ground water; laboratory decomposition studies and salmonella; and effect on soil water and the soil. Poultry manure was used as the organic waste, and there was no indication of ground water pollution by fecal coliform. The upper limit of poultry manure disposal appeared to be less than 15 tons per acre of dry material because of nutrient contamination in the soil water. The PFC technique utilized the soil media for degradation and the eventual utilization and recycling of organic wastes by plants.

1363 - B1, C5, D4

EFFECTS OF PARTICLE SIZE ON THE AEROBIC TREATMENT OF ANIMAL WASTE

James A. Lindley.
MS Thesis, Department of Agricultural Engineering, Purdue University, 1970, 122 p. 31 fig, 41 tab, 38 ref.

Descriptors: *Farm wastes, *Aerobic treatment, *Particle size, Chemical oxygen demand, Biochemical oxygen demand, Aeration, Sampling, Analysis, Feeds, Dairy industry, Cattle, Waste treatment, Volatility, Digestion, Nebraska.
Identifiers: Refeeding.

Design of efficient treatment processes (such as aerobic biological treatment) requires a thorough knowledge of the waste and effects of variation in this material. Research was conducted to study the effects caused from differences of fractions with particle sizes that could be measured by sieving techniques. The results of analyzing 24 samples of dairy farm wastes gave an average geometric mean particle size of 860.85 microns. The mean range was from 1490 microns to 402 microns. Organic content was found to increase with particle size of 860.85 microns. The mean range was from 1490 microns to 402 microns. Organic content was found to increase with particle size, while chemical oxygen demand and biochemical oxygen demand varies inversely with particle size. The rate of volatile solids decomposition in an aerobic treatment process may decrease with larger waste fineness values, but the effect is slight. (Frantz-East Central).

1364 - B2, C2, C5

SETTLING SOLIDS IN ANIMAL WASTE SLURRIES

J. A. Moore, R. O. Hegg, D. C. Sholz, and Egon Strauman.
Presented at the 66th Annual Meeting, American Society of Agricultural Engineers, University of Kentucky, Lexington, June 17-20, 1973, 17 p. 5 fig, 1 tab, 14 ref.

Descriptors: *Farm wastes, *Slurries, *Sedimentation, Sampling, Chemical oxygen demand, Livestock, Waste treatment, Suspended solids, Design data, Feed lots, Solid wastes, Minnesota.
Identifiers: *Settling solids, Total solids, Volatile solids.

Research was conducted to develop design curves which may be used in applying sedimentation principles to the treatment of animal wastes. Samples of slurries were measured for solids at the tops of cylinders at O, 1, 10, 100 and 1000 minutes. The chemical oxygen demand, total solids (TS), and total volatile solids (TVS) were determined for waste samples from poultry, beef and dairy cattle, horses, and swine. It was concluded that settling can efficiently remove TS and COD. The shapes of the design curves were almost identical regardless of the percent TS slurry within the range of 1 to .01%. TS values were generally higher than COD values. For closed recycling systems, one to ten minutes of detention time might be used for design purposes. (Frantz-East Central).

1365 - B2, C5, E3

QUALITY DEGRADATION OF DAIRY WASHWATER

A. C. Chang, G. Yamashita, J. B. Johnson, K. Aref, and D. C. Baier.
Presented at the 1973 Annual Meeting, American Society of Agricultural Engineers, University of Kentucky, Lexington, June 17-20, 1973, Paper No. 73-440, 21 p.

Descriptors: *Quality control, *Degradation (Decomposition), *Dairy industry, *Groundwater pollution, *Farm wastes, Cattle, Waste disposal, Effluent, Chemical properties, Physical properties, Nitrogen, Salts, Chemical oxygen demand, Waste water (Pollution) Return flow, California.
Identifiers: *Wastewater.

Representative samples from twenty-five dairies, divided into five groups according to size, were evaluated for quality degradation of dairy washwater. The water supply was totally dependent upon the underground source. The physical and chemical properties of wastewater were compared with those of the water used before washing. The greatest increase was in chemical oxygen demand, total nitrogen and total dissolved salts. The increment was at least 4-5 times higher than that in water used for domestic purposes. Removal of nitrogen and dissolved salts is the major concern for making water more suitable for land disposal. (Frantz-East Central).

1366 - A1, B2, E2, F1

WATER POLLUTION BY DAIRY FARM WASTES AS RELATED TO METHOD OF WASTE DISPOSAL

Auburn University, Auburn, Alabama, Water Resources Research Institute.
T. A. McCaskey, G. H. Rollins, and J. Little.
Water Resources Research Institute Bulletin 18, 1973, 86 p. 12 fig, 24 tab, 3 append.

Descriptors: *Livestock wastes, *Manure, *Dairy farms, *Waste disposal, Soil disposal fields, Irrigation waste disposal, Manure lagoons, Runoff, Water quality.
Identifiers: *Waste disposal methods, *Field spreading, *Manure loading rates, Runoff quality, Lagoon efficiency.

Three field spreading methods and a lagoon system were evaluated for the disposal of dairy cow waste. Three rates of waste were applied to grassland plots by each of the field spreading methods for 27 months. Runoff water was collected from the plots, and also from a check plot to evaluate runoff water quality. The scrape-haul method contributed more BOD load to runoff, and more fecal coliforms and nitrate to the soil than the irrigation or tank-wagon methods. The most BOD and nitrate in runoff during 1971 for all methods of field spreading waste occurred during August during which the rainfall was lowest for the year. The least BOD and nitrate in runoff coincided with the month of most rainfall (March). At 10 to 21 tons waste applied annually on grassland there was not an appreciable deterioration of runoff water quality nor buildup of soil nitrate. A two-stage lagoon system designed for 30 cu. ft. storage capacity per cow in the first stage and 643 cu. ft. capacity in the second stage for cows using milking facilities reduced BOD, 89%, COD, 93% Kjeldahl-nitrogen, 82% and fecal coliforms, 99%. For herds of 120 cows in confinement the estimated annual cost per cow for manure management by the irrigation method was $30.31 and $34.07 for the scrape-haul method. The cost for systems that accomodated cows during milking was estimated at $11.24 per cow for the lagoon method and $21.21 per cow for the tank-wagon method. (McCaskey-Auburn).

1367 - A2, A4, E2

MICROBIAL CHANGES AND POSSIBLE GROUND WATER POLLUTION FROM POULTRY MANURE AND BEEF CATTLE FEEDLOTS IN GEORGIA

Department of Agronomy, University of Georgia, Athens.
J. Giddens, A. M. Rao, and H. W. Fordham.
Completion Report. USDI/OWRR Project No. A-031-Ga. Department of Agronomy, University of Georgia, May, 1973, 57 p. 14 fig, 16 tab, 6 ref.

Descriptors: *Groundwater pollution, *Farm wastes, *Poultry, *Feed lots, *Cattle, *Georgia, Nitrates, Nutrients, Coliforms, Agricultural runoff, Ammonia, Volatility.
Identifiers: *Microbial changes, *Manure.

Laboratory and field studies were made to determine the effect of methods of application and handling poultry manure upon nitrate and other nutrients in the soil and microbial changes during decomposition. One-half the nitrogen in poultry manure volatilizes upon air-drying. Repeated light manure applications produced less soil nitrate than the same total amount applied less frequently, and soil surface applications produced less nitrate than when soil incorporated. Coliform bacteria decreased rapidly when manure was mixed with soil or when exposed to ammonia. Soil fungi decreased during early manure decomposition stages. Coliforms were at a high level in pond water when periods of rainfall runoff occurred. A survey of soil at 21 beef cattle feedlots indicated that groundwater contamination from the feedlots would probably not be significant but that contamination from surface runoff would possibly present a greater pollution hazard. (Giddens, et. al.,—Georgia University).

1368 - B1, D1, E1, F4

ENVIRONMENT PROTECTING CONCEPTS OF BEEF CATTLE FEEDLOT WASTES MANAGEMENT

Robert S. Kerr Environmental Research Laboratory, Ada, Oklahoma.
L. R. Shuyler, D. M. Farmer, R. D. Kreis, and M. E. Hula.
National Animal Feedlot Wastes Research Program, Robert S. Kerr Environmental Research Laboratory, July, 1973, 283 p. 71 fig, 62 tab, 197 ref.

Descriptors: *Feed lots, *Farm wastes, *Design, Regulations, Legal aspects, Climates, Sites, Agricultural runoff, Slurries, Solid wastes, Liquid wastes, Waste storage, Waste treatment, Waste disposal.
Identifiers: Environmental protection, *Pollution control.

This report is meant to serve as a guide to insure consideration and incorporation of pertinent environmental pollution controls in the design and operation of beef cattle feedlots. The report is written to serve as a reference source for the more detailed information contained in published literature on feedlot design and operation. Feedlot design and waste management alternatives are presented. Aspects of feedlot site selection such as regulations, spatial requirements, topographic features, microclimates, soils and geological features, social considerations, and practical applications are discussed. Solid waste control and liquid waste technology is presented and the economic consideration of each system is dealt with. The information and guidelines presented aren't restricted to cattle feedlots. They are also applicable to other segments of the animal industry. (Russell-East Central).

1369 - A5, D3, D4

GAS CHROMATOGRAPHIC ANALYSIS OF ODORS FROM DAIRY ANIMAL WASTES

Ohio State University, Columbus.
R. White.
Ph. D. Thesis, Department of Agricultural Engineering, Ohio State University, 1969, 143 p. 36 fig, 23 tab, 61 ref.

Descriptors: *Gas chromatography, *Analysis, *Odor, *Dairy industry, *Farm wastes, Cattle, Waste treatment, Sampling, Measurement, Liquid wastes, Waste storage, Temperature, Hydrogen ion concentration, Aeration, Volatility.
Identifiers: *Malodors, *Odor index peaks.

Recent developments in confinement animal production has brought into focus the problem of odor nuisance from dairy animal units. Gas chromatographic analysis was used to analyze the odors from simulated liquid storage of dairy manures. The equilibrium collector, transfer apparatus, and injection apparatus as developed in this study, functioned to give reliable, repetitive analyses of the head space gas over dairy manures. Eleven odor index peaks were characteristic of untreated dairy wastes. Six of these were identified as hydrogen sulfide, methanethiol, dimethyl sulfide, propyl acetate, and n-butyl acetate. The effect of aeration was to reduce or eliminate the thiol, sulfides, and acetates. The effect of pH and electrode potential had about the same effect as aeration. When calcium hydroxide was added at the beginning of a test a slight reduction in odor was indicated. The apparatus developed has now made it possible to extend study into more comprehensive investigations of odor and management in animal production units. (Russell-East Central).

1370 - A4, E2

TRANSACTIONAL DYNAMICS OF POULTRY MANURE IN SOIL

L. H. Hileman.
Paper presented at 1972 Winter Meeting, American Society of Agricultural Engineers, Chicago, Illinois, December 11-15, 1972, Paper No. 72-956, 15 p. 6 fig. 4 ref.

Descriptors: *Farm wastes, *Poultry, *Soils, *Leaching ion exchange, Ground water pollution, Calcium, Potassium, Ammonia, Manganese.
Identifiers: *Manure, *Transactional dynamics.

Poultry broiler manure was surface applied to Taloka silt loam soil columns at rate of 0, 2, 4, 6, 8, 10, 20, and 40 tons per acre. The soil columns were leached with distilled water at the rate of approximately one acre inch per week for 16 weeks. The gravitationally leached water was collected for chemical analysis. Data presented indicated the intensity of dynamic transaction and cation exchange taking place in the soil due to the large application of litter. Potassium in the manure exchanged for soil calcium. Calcium in the leachate reached 800 ppm. High levels of manganese were found in the leachate. Consideration must be given to the soil and to the soil water when applying high rates of poultry manure. (Cartmell-East Central).

1371 - A1, B1, F2

FEEDERS IGNORE POLLUTION RULES: RISK STIFF FINES

BEEF, Vol. 10, No. 7, p. 70-71, March, 1974.
3 fig.

Descriptors: *Feed lots, *Regulation, *Fines, *Permits, Cattle, Weather, Equipment, Effluent, Waste disposal.
Identitfiers: *Rules, *Pollution, *Environmental Protection Agency, *Waste management, Discharges.

Feedlot operators can be fined as high as $25,000-a-day if they haven't filed for an Environmental Protection Agency waste discharge permit. A large number of feeders across the United States are running the risk of being hit with these fines. Any feedlot operator who has one thousand head or more in his feedlot must have a permit in order to discharge waste legally. Also, anyone who is notified that he is a "significant contributor of pollution" must apply for a permit. After permits are drafted, they are put on public notice for thirty days. If there are public comments, then a hearing must be held to clear up misunderstandings. When a person files for a permit, his operation is investigated and construction of waste handling systems is ordered if needed. The EPA guidelines establish an effluent limitation of "no discharge" by 1977, but exceptions will be made for extreme weather. It is hoped that by such action, pollution from animal wastes will be controlled. (Russell-East Central).

1372 - D3, E3, F1

FEEDLOT MANURE AND OTHER AGRICULTURAL WASTES AS FUTURE MATERIAL AND ENERGY RESOURCES: III. ECONOMIC EVALUATIONS

Department of Chemical Engineering, Kansas State University, Manhattan, 66506.
W. P. Walawender, L. T. Fan, C. R. Engler, and L. E. Erickson.
Contribution Number 33, Department of Chemical Engineering, Kansas Agricultural Experiment Station, Manhattan, July 1, 1973, 23 p. 9 tab, 45 ref.

Descriptors: *Feed lots, *Farm wastes, *Recycling, *Energy, *Waste treatment, *Waste disposal, Economics, Costs, Transportation, Carbon dioxide, Water.
Identifiers: *Manure, *Agricultural wastes, *Liquifaction, *Gasification, *Hydrogasification, *Oil conversion, Cellulosic wastes, Processing.

Due to increasing waste problems and energy demands, a study of the feasibility of chemical processing of agricultural wastes was undertaken. The study dealt primarily with feedlot manure because of its availability and its present hazards to environmental quality. This report presents the results of an economic analysis of three potential processing schemes for the conversion of feedlot wastes to useful products. The processes include (1) liquefaction to oil, (2) gasification to synthetic gas, and (3) hydrogasification to methane. Processing costs, on a per ton of wet manure feed basis, were found to be $4.27, $1.53, and $9.41, respectively. (These costs include credit only for the sale of the major product at approximately current prices.) Capital investment and the break-even sales price for the major product are presented. The results strongly favor the synthesis gas process; however, markets for the product require further consideration. (Russell-East Central).

1373 - B1, D1

HOUSING AND SHELTER FOR FEEDLOT CATTLE

University of Minnesota.
J. C. Meiske, R. E. Smith, R. D. Goodrich, and H. E. Hanke.
FEEDLOT MANAGEMENT, 1973 CATTLE FEEDER'S PLANNER, November, 1973, p. 44-52, 84.
5 fig, 3 tab.

Descriptors: *Feed lots, *Cattle, *Confinement pens, Costs, Economics, Performance, Farm wastes, Feeding, Weather, Design.
Identifiers: *Housing, *Shelter, Open shed, Open lot, Manure pack system, Insulated confinement barn.

In the selection of a feedlot facility, consideration must be given to factors such as weather, pollution control regulations, the need to save labor, and the desire to eliminate bedding and to provide an environment which would enable cattle to have improved feed efficiencies and faster gains. Five types of feedlot facilities were studied. These were: (1) the open confinement shed; (2) the manure pack system; (3) the conventional open shed; (4) the enclosed insulated confinement barn; and (5) the open lot unit. Of these systems each has advantages and disadvantages, and the best system would be the one that best fits a particular need and operation. The lowest cost per head system is the open lot unit, and the most expensive is the insulated confinement building. However, gain is greater in the confinement building than in the open lot. In other words, no particular system is superior to all others. Each system's success is dependent on a particular set of circumstances and, with all systems, good construction and alert management are necessary for consistent returns. (Russell-East Central).

1374 - B1, D2, E2, E3

A FEEDLOT WITHOUT WASTE

Editor of BEEF.
P. D. Andre.
BEEF, Vol. 10, No, 1, p. 56-66, 69-70, Sept., 1973.
5 fig.

Descriptors: *Feed lots, *Farm wastes, *Cattle, *Confinement pens, *Recycling, *Waste treatment, *Waste disposal, Urine, Methane, Liquid wastes, Solid wastes, Separation techniques, Feeds, Nitrogen, Dehydration, Costs, Arizona.
Identifiers: Refeeding, Sterilization.

A system or theory for the solution to the feedlot industry's manure problems has been devised by Dick Bunger who is the president of Corral Industries Inc. He has called this the "Closed Ecological Cycle Feeding System." As he sees it, feeding in the future must be in confinement buildings. This is because of the increasing scarcity of land, pollution regulations, and weather. His studies show that confinement feeding produces the same gains as open feedlot, but it produces better gains during bad weather. This system first collects the waste and separates urine and feces. The liquids then go to a methane gas generator. The by-products of the liquids are then safe to be spread on land. By running the liquids through the gas generator, the nitrogen and other chemicals are reduced so that for a 10,000 head feedlot, instead of needing 4,204 acres for spreading the raw materials, only 200-500 acres would be required in one year's time. The solid matter is sterilized and then is incorporated into the feeding ration. (Russell-East Central).

1375 - B2, D4

THE EFFECT OF LOW VOLUME AND HIGH VOLUME AERATION ON A HOG LAGOON

J. C. Converse.
MS Thesis, Department of Agricultural Engineering, North Dakota State University, May, 1966, 85 p. 44 fig, 5 tab, 19 ref.

Descriptors: *Hogs, *Farm wastes, *Waste treatment, *Lagoons, *Aeration, Temperature, Hydrogen ion concentration, Biochemical oxygen demand, Chemical oxygen demand, Suspended solids, Ammonia, Nitrates, Nitrites, Sampling, Oxidation-reduction potential, Dissolved oxygen.
Identifiers: Total solids, Volatile acids.

The objectives of the study were to evaluate the effects of low and high volume subsurface aeration on a hog lagoon. Laboratory tests were run on low and high volume samples and control samples. Among factors tested were: Temperature, pH, BOD, COD, total and suspended solids, ammonia, nitrate, nitrite, ORP, volatile acids (high volume aeration) and DO (high volume aeration). The low volume subsurface aeration which ranged from 3.6 cfm had no measurable effect on the hog lagoon. For all of the tests conducted there appeared to be no significant difference between the means of the values obtained in the test for the aerated and the control cells. During the high volume aeration phase, an average of 2.28 mg/l of dissolved O2 was maintained in the aerated cell during the testing period. All of the tests showed a significant difference of the means, except the total solids, the suspended solids, the organic matter, and the ammonia. Based on the analysis of this experiment, it may be beneficial to aerate a hog lagoon with at least enough air to maintain some dissolved oxygen in the lagoon. The aeration would allow the lagoon to be loaded at a higher rate and still maintain aerobic conditions. Economical considerations may make this unfeasible. (Cartmell-East Central).

1376 - A2
POLLUTION POTENTIAL OF RUNOFF FROM PRODUCTION LIVESTOCK FEEDING OPERATIONS IN SOUTH DAKOTA

Civil Engineering, Water Resources Institute, South Dakota State University.
J. N. Dornbush, and J. M. Madden.
Completion Report, April, 1973, 37 p. 3 fig. 12 tab, 3 ref.

Descriptors: *Agricultural runoff, *Feed lots, *Livestock, *South Dakota, *Farm wastes, Nutrients, Rainfall-runoff relationships, Snowmelt, Biochemical oxygen demand, Chemical oxygen demand, Solids, Pollutants.
Identifiers: *Pollution.

The quantity and quality of runoff from six feedlots in eastern South Dakota has been measured over a 3-year period. Annual precipitation at the feedlots ranged from 19 to 25 inches which was about normal for the area. Snowmelt accounted for 27% of the mean runoff of 7.2 inches for the six lots. After snowmelt runoff, rainfall caused only about 10 runoff events per year and about 50% of the runoff events were less than 0.25 inches. Average annual losses of waste constituents in the runoff in lbs/acre/yr were total solids—10,232, BOD-1816, COD—7496, total phosphate—351, and Kjeldahl nitrogen—533; although, there was wide variation between lots. Removal of solids from the runoff would reduce the pollution potential by about 35% for most constituents. Less than 5% of the total waste generated on a lot was removed with surface runoff. Minimum detention facilities, diverting foreign drainage and reduction of runoff velocities, will reduce the pollution potential to less than 2% of the total animal wastes produced. (Dornbush and Madden-South Dakota State University).

1377 - B1
WHAT TO DO ABOUT POULTRY'S PROTEIN-ENERGY CRISIS

Poultry Science Department, University of Georgia, Athens.
L. S. Jensen.
Poultry Digest, Vol. 32, No. 381, p. 489-492, November, 1973, 1 fig.

Descriptors: *Poultry, *Proteins, *Energy, Ammino Acids, Feeds, Diets, Recycling, Management.
Identifiers: Antibotics, Fats, Calories.

It may be necessary to develop new sources of nutrients, use existing sources more efficiently and make some changes in management to offset the increasing costs of feeds. Jensen cites the following as means of improving nutritional formulation of poultry rations: (1) Reduce protein levels, (2) Use synthetic amino acids, (3) Improve feed quality control, (4) Consider "extra caloric effect of fat, (5) Use effective antibotics for growth stimulation, (6) Consider protein or amino acid sparing factors. Limiting feeding, controlling feed wastage, and identifying factors causing variations in the performance among contract growers should also bring about a better overall utilization of expensive broiler feed. (Ballard-East Central).

1378 - B1, E2, E3
THE BUILDING OF A FEEDLOT

Mower Lumber Company, Eutawville, South Carolina.
P. W. Schumacher.
Presented at the 1973 Winter Meeting, American Society of Agricultural Engineers, Chicago, Illinois, December 11-14, 1973, Paper No. 73-4542, 7 p.

Descriptors: *Feed lots, *Farm wastes, *Cattle, *Waste disposal, *Dairy industry, Fermentation, Feeds, Humidity, Recycling, South Carolina.
Identifiers: *Manure-flush system, Refeeding, Silos, Feed efficiency, Shade, Land spreading.

With the establishment and maintenance of a feedlot operation on Walworth Farms, Eutawville, South Carolina, it was shown that cattle feeding can be done successfully in the Southeastern United States. A liquid pipeline system was constructed in which wastes were flushed from sloping concrete pens, carried off by pipeline, and spread over the surrounding sandy cropland. A fermentation feeding method was developed which resulted in 10 to 12 percent improved feed efficiency and 8 to 12 percent weight gain increase. Also discussed are the environmental effects of manure spreading and of refeeding solid wastes separated by the liquid handling method. (Hargrove-East Central).

1379 - B3, D4, E2
SOLID WASTE MANAGEMENT ALTERNATIVES

B. Sullivan.
Feedlot Management, Vol. 15, No. 5, p. 26-30, May, 1973.

Descriptors: *Solid wastes, *Farm wastes, *Feed lots, *Waste storage, *Waste disposal, *Economics, Costs, Transportation, Fertilizers, Equipment, Nitrogen, Cattle.
Identifiers: *Waste management, Commercial loader, Spreader truck, Rotary scraper, Windrow composting.

Solid manure management involves collection, transportation, storage, processing and disposal —operations that encompass an array of techniques and equipment which can be used in many combinations. The costs of these operations and removal vary with feedlot size, annual days of equipment use, and manure hauling distance. An economic comparison is made of the use of a commercial loader (skip loader) and a spreader truck, a rotary scraper attached to a tractor, and a self-propelled elevating scraper. The pros and cons of waste storage by composting in windrows and of waste disposal on crop lands are also considered. (Cameron-East Central).

1380 - B1
RESEARCH CONCEPTS

W. O'Rourke.
Calf News, Vol. 10, No. 4, p. 16, 48, April, 1972. 1 tab.

Descriptors: *Research, *Cattle, *Feeds, *Water consumption, *Growth rates, Confinement pens, Energy, Economics, Farm wastes, Tennessee.
Identifiers: *Water restriction, Roughage, Weight.

Raising calves in a feedlot requires energy restriction. This may be done by (1) Feeding roughages such as hay, straw, and corn, and (2) Feeding a limited amount of an energy-dense feed formulated to supply daily requirements of essential nutrients. Both methods have drawbacks, however, which leads to the question approached in the experiment—can feed intake be closely controlled through water restriction? Three small pens (30' by 90') were adapted to study the effect of water restriction on feed consumption. Fifteen 450 pound steer calves were placed in each pen. One pen of calves was fed chopped alfalfa hay, plus a 1:1 mixture of salt and decalcium phosphate. The calves in the remaining two pens were changed to a high-energy finisher ration. One pen of the calves received only a measured amount of water each day. The results showed that cattle health, gain, and feed efficiency after fill were encouraging. Water restriction is a useful way to reduce feed consumption and restrict gain. Feed efficiency in comparison to the hay-fed cattle is marked and with milo presently costing less than medium quantity alfalfa hay, the economy of restricting intake of a high energy ration by water restriction is excellent. (Drewry-East Central).

1381 - B1
BAFFLED CENTER CEILING VENTILATION INLET

Agricultural Engineering Department, South Dakota State University, Brookings.
M. A. Hellickson.
Transactions of the ASAE, Vol. 16, No. 4, p. 758-760, July-August, 1973, 6 fig. 13 ref.

Descriptors: *Ventilation, *Temperature, *Intakes, *Baffles, *Cattle, *Air circulation.
Identifiers: *Ceiling ventilation, *Inlet, Exhaust fans, Manure pit.

In the summers of 1970 and 1971, studies were made on the ventilation characteristics in the Farmers' Union Grain Terminal Association's 48 by 40 ft. closed confinement beef unit. The original ventilation system employed two thermostatically controlled variable speed exhaust fans and four constant speed exhaust fans. This design allowed summer ventilation air to enter the building through baffled 4 inch continuous inlets along the north and south walls. The inlet system was redesigned prior to use during the summer of 1971. The new design employed a center ceiling inlet for year-round ventilation. Air movement in the closed environment beef unit during 1970 almost exclusively occurred in the upper portion of the building. In 1971, air circulation around the animals was clearly noticeable and ventilation was much better. Average temperature at animal level from June 26 to October 30, 1971, exceeded average outside temperature by 4.4° F. In 1970, the average temperature at animal level exceeded average outside temperature by 9.6° F. In 1971 tempering of ventilation air in the north half of the attic ranged from 5° F above to 20° F below and averaged 0.2° F above outside temperature from June 26 to October 30. Although solar tempering was greatest during hot weather, ambient temperature exceeded outside temperature more during periods of cooler temperature. (Cameron-East Central).

1382 - A2, A5, B1
SOLIDS TRAP FOR BEEF CATTLE FEEDLOT RUNOFF

United States Department of Agriculture, Lincoln, Nebraska.
N. P. Swanson and L. N. Mielki.
Transactions of the ASAE, Vol. 16, No. 4, p. 743-745, July/August, 1973. 2 fig. 2 tab.

Descriptors: *Cattle, *Feed lots, *Agricultural runoff, *Solid wastes, *Waste storage, *Waste treatment, Sediment transport, Physical properties.
Identifiers: *Solids trap.

Solids transported by runoff from cattle feedlots and allowed to deposit in a holding pond in uncontrolled quantities create three serious problems. First, runoff storage capacity is reduced by deposited solids. Second, emptying by pumping is difficult when solids have accumulated.

Third, decomposition of the solids produces odors in warm weather. In 1969, a solids trap consisting of a broad, flat channel 14 feet wide and 80 feet long was installed to pass the runoff collected from a sloping 0.85-acre feedlot. The channel was about 2½ feet deep and sloped only 3 or 4 inches toward the discharge end. Mesh galvanized hardwarecloth screens were installed vertically across the channel and placed 35 and 55 feet from the inlet end of the channel. On July 23, 1971, 21 cubic yards of solids were removed from the holding pond. This was the total accumulation of settleable solids from July 3, 1969. In this two-year interval, the trap retained 81 cubic yards of sediments from 12.33 inches of runoff produced by 50.77 inches of precipitation. No problems arose in removing the solids from the trap. Installation of a concrete or crushed rock surface in the channel bottom may be desirable where removal of solids with higher water contents is required. (Drewry-East Central).

1383 - B1

BROILER LITTER MANAGEMENT

Department of Poultry Science, Oregon State University.
R. W. Dorminey, and P. H. Weswig.
Unpublished paper, 3 p.

Descriptors: *Poultry, *Litter, *Management, Broods, Weather, Chemical analysis, Nitrogen, Oregon.
Identifiers: *Broilers, *Composting, Fir shavings, Commercial additive, Cedar mulch.

Six instructions for composting litter were given and discussed. A series of experiments was conducted with four treatments being used: (1) pens cleaned out and new fir shavings added after each brood; (2) one to two inches plus wet spots removed and replaced with new fir shavings; (3) fir shavings used once, then composted after each brood using the commercial additive; and (4) fir shavings used once, then composted after each brood without the commercial additive. A total of eight different broods were grown on composted litter. It was found that if the litter is dry and the weather conditions are moderately warm and dry when the litter is composted, the litter will dry sufficiently and broiler performance will equal or exceed that obtained with etiher new litter or with litter reused without composting. Litter can be composted without a commercial additive with exactly the same effects. Chemical analysis showed higher percentages after the composting for all elements except nitrogen. A material called cedar mulch can be satisfactorily used as a broiler litter and can be composted. (Cartmell-East Central).

1384 - A5, B2, D1, E2

CONCRETE AND ALUMINUM FLOORS FOR CONFINEMENT BEEF FINISHING

Professor and Associate Head, Agricultural Engineering Department, University of Tennessee, Knoxville,
J. I. Sewell, and G. D. Miller.
Presented at 1973 Winter Meeting, American Society of Agricultural Engineers, Chicago, Illinois, December 11-14, 1973, 11 p. 2 tab, 7 ref.

Descriptors: *Concrete, *Confinement pens, *Cattle, *Farm wastes, *Waste storage, *Waste treatment, *Waste disposal, Performance, Costs, Odor, Tennessee.
Identifiers: *Slatted floors, *Aluminum, *Beef finishing, Gains.

A slatted-floor beef finishing facility was completed in the fall of 1971 at the University of Tennessee Aluminum Company of America Farm. An existing barn with a concrete-slab floor was remodeled to include aluminum slats and reinforced-concrete slats installed over reinforced manure collection pits in half the barn (six pens), while the slab was left intact in the other half (four pens). The liquid manure in the pits was agitated, removed from the pits by liquid manure tank-spreaders, and spread on crop or pasture land. Data were collected on facility design, costs, manure accumulation rates, manure removal procedures, stocking, density, for manure management on slatted-floor and concrete-slab floor systems. Bulls fed on floors of aluminum slats, concrete slats, and concrete slabs exhibited similar gain performance. After two years, the aluminum slats have been only slightly damaged by electrolysis or the weight of the cattle. Aluminum slats were noticeably cleaner than concrete slats. (Cartmell-East Central).

1385 - C5, D2, E3

CHEMICAL COMPONENTS AND ESTIMATED DIGESTIBILITY OF DEHYDRATED CATTLE MANURE

Bureau of Reclamation, Grand Junction, Colo.
C. W, Berg, G. L. Pratt, M. L. Buchanan, and D. O. Erickson.
Presented at the 1973 Winter Meeting, American Society of Agricultural Engineers, Chicago, Illinois, December 11-14, 1973, 13 p. 7 fig, 4 tab, 4 ref.

Descriptors: *Farm wastes, *Cattle, *Dehydration, *Chemical properties, Temperature, Moisture content, Sampling, Silica, Lignins.
Identifiers: *Manure, *Digestibility, Mineral content, Fiber.

Beef cattle manure samples were dried at 100°, 150°, or 200°F. At each temperature, samples were dried to final moisture contents of 14, 8, and 1 percent. Storage time was evaluated by varying the number of days that elapsed between cleaning operations in the barn. These intervals were 1, 2, 3, and 4 days. The manure still contained about 20 to 25 percent estimated digestible dry matter. The mineral content of the manure was higher than the ration. Increasing the drying temperature from 100° to 200°F, resulted in an increase in fiber, lignin and silica and a reduction in digestibility. There were little differences in chemical composition or digestibility of manure dried at 14 percent versus 8 percent, but 1 percent increased silica, fiber and lignin. Protein content decreased in the manure dried to 8 percent compared with that of 14 percent. Protein was reduced with time in storage in the pit. (Cartmell-East Central).

1386 - B1, C5, D1, E2

NEW CONCEPTS FOR DAIRY WASTE MANAGEMENT

School of Public Health, University of California, Los Angeles,
C. L. Senn.
Journal of Milk and Food Technology, Vol. 35, No. 12, p. 703-707, December, 1972.

Descriptors: *Dairy industry, *Farm wastes, *Waste treatment, *Waste disposal, *Waste storage, *Recycling, Water pollution, Air pollution, Feed lots, Waste water treatment.
Identifiers: *Waste management, *Composting, Aeration, Earth corrals, All-paved corrals, Environmental housing.

Public concern, coupled with that of health, agricultural, and milk industry people, prompted a dairy waste management project funded by the Environmental Protection Agency. The study included not only earth corrals, but also covered all-paved corrals—both water-flushed and mechanically cleaned. A simple aeration process produced compost at low cost. The product was "pasteurized," weed-seed free, and an attractive soil amendment. Aerobic composting with "environmental housing" and with aerobic treatment of liquid dairy farm wastes, gives promise of providing relatively nuisance-free and pollution-free, high density housing for approximately 200 cows per acre. (Drewry-East Central).

1387 - B2, C5, D4

HOW TO PLAN AND MANAGE A LAGOON

Associate Swine Editor of Successful Farming.
B. Eftink.
Successful Farming, Vol. 71, No. 8, p. H4, June-July, 1973. 1 fig.

Descriptors: *Lagoons, *Planning, *Management, *Waste disposal, *Farm wastes, Hogs, Sludge, Aerated lagoons, Anaerobic conditions, Livestock.
Identifiers: Bedding.

To plan and manage a lagoon properly and effectively, there are several steps to follow. The lagoon must be built downwind from houses, away from water wells, yet close to the animals. The lagoon should also be large enough to contain the sludge from the animals. The lagoon should also be large enough to contain the sludge from the animals. Once the lagoon starts working, it's better to make frequent, small loadings instead of uneven, large loadings which cause bacteria fluctuations and poor decomposition. (Ballard-East Central).

1388 - B1, C5, E2, E3

BIODEGRADING POULTRY EXCRETA WITH HOUSE FLY LARVAE: THE CONCEPT AND EQUIPMENT

Entomology Research Division, Agricultural Research Service, United States Department of Agricultre.
N. O. Morgan, C. C. Calvert, and R. D. Martin.
ARS 33-136, United States Department of Agriculture, Agricultural Research Service, February, 1970, 3 p, 1 fig, 2 ref.

Descriptors: *Poultry, *Farm wastes, *Biodegradation, Fertilizers, Organic wastes, Waste treatment, Waste disposal, Recycling, Equipment.
Identifiers: *Excreta, *House fly larvae, White leghorns.

The excretion of one White Leghorn laying hen amounts to 0.25-0.40 pound per day. This daily production creates an enormous disposal problem. In biodegradation experiments in Beltsville, Maryland, larvae of the house fly are being used to process the raw excreta of hens to produce a fertilizer or soil conditioner and a feed supplement. These experiments involve the hatching of the fly eggs on poultry feces. The eggs hatch and the larvae develop. The larvae then aerate the medium by their tunneling. (Ballard-East Central).

1389 - B3, C5, D2, E2, E3

POULTRY ANAPHAGE IS HERE TO STAY

College of Agriculture and Natural Resources, Michigan State University, East Lansing.
H. C. Zindel.
Egg Industry, Vol. 6, No. 7, p. 22, 2 fig. 5 ref.

Descriptors: *Poultry, *Farm wastes, *Feeds, *Recycling, Productivity, Fertility, Calcium, Phosphorous, Waste treatment, Waste disposal,
Identifiers: *Dried poultry wastes, Hatchability, Necropsy.

On the basis of research, feed costs, and feed ingredient availability, dried poultry wastes were found practical and suitable for poultry and livestock feed. At Michigan State University, a 12.5 to 25 percent dried poultry waste diet replacement in poultry feeding over a 14 month period caused no change in production, fertility, or hatchability, and no discernible difference was revealed by necropsy. Potential poultry waste sales outlets are livestock and poultry feeds, mushroom culture media, and organic fertilizers. Since phosphorous and calcium were found to increase in recycling, feeding of dried poultry waste as a diet replacement should not exceed 25 percent. Keys to successful poultry waste dehydration are: (1) operation economy and ease, (2) packaging unity, (3) low service and maintenance costs, (4) emission control, (5) consistent and uniform production, (6) efficient continuous operation, and (7) compliance with EPA odor, smoke, and particulate standards. (Hargrove-East Central).

1390 - B1, C3

FECAL ELIMINATION OF ESTROGENS BY CATTLE TREATED WITH DIETHYLSTILBESTROL AND HEXESTROL

Department of Animal Science, Purdue University, Lafayette, Indiana.
M. R. Callantine, M. Stob, and F. N. Andrews.
American Journal of Veterinary Research, Vol. 22, p. 462-465, May, 1961. 2 tab, 13 ref.

Descriptors: *Farm wastes, *Cattle, *Sampling, Water pollution, Soil contamination, Fertilizers.
Identifiers: *Estrogens, *Diethylstilbestrol, *Hexestrol, Hormones.

The estrogenic activity of the feces of estrogen-treated and control heifers in 6 groups was determined during a 24-week period following initiation of hormone treatment. Animals given 10 mg. of diethylstilbestrol orally per day excreted significantly more estrogen than did the controls or heifers subcutaneously treated with 24 or 36 mg. of either diethylstilbestrol or hexastrol. This excretion was uniformly high for the entire experimental period. Subcutaneous implantation with 36 mg. of diethylstilbestrol resulted in a greater total estrogen excretion than treatment with 24 mg. However, significant amounts of estrogen were excreted for 60 days following treatment with 24 mg. of diethylstilbestrol when compared to that excreted for 51 days following 36 mg. implantations; after this time, fecal estrogen elimination of heifers in both groups was similar to the controls. Implantation of heifers with 24 or 36 mg. of hexestrol did not result in greater fecal estrogen elimination than in the animals not given supplementary estrogen; neither treatment produced significant weekly variation in estrogen excretion. (Callantine, Stob, Andrews-Purdue University).

1391 - A2, B2, D4

AEROBIC TREATMENT OF FEEDLOT RUNOFF

Department of Civil Engineering, University of Nebraska, Lincoln.
Terence J. McGhee, R. L. Torrens, and R. J. Smaus.
Journal Water Pollution Control Federation, Vol. 45, No. 9, p. 1865-1873, Sept., 1973. 4 fig, 7 tab, 14 ref.

Descriptors: *Feed lots, *Agricultural runoff, *Aerobic treatment, *Waste treatment, Cattle, Farm wastes, Physical properties, Chemical properties, Chemical oxygen demand, Biochemical oxygen demand, Liquid wastes, sludge.

The feedlot runoff used in this study was obtained from the University of Nebraska. The units were operated at liquid retention times of 1-8 days. The study was conducted at room temperature. It was determined that an aerobic biological system can effectively treat settled feedlot runoff. Reductions of chemical oxygen demand of sixty percent may be obtained. Liquid retention times of three days or more are sufficient to insure satisfactory treatment. The color of the runoff is affected slightly by aerobic treatment. Analysis of chemical oxygen demand is superior to the 5-day biochemical oxygen demand determination in evaluating the efficiency of treatment and the strength of feedlot runoff. (Cartmell-East Central).

1392 - B1, E3

MORE BEEF ON THE HOOF: GOAL OF OHIO RESEARCH

Feedlot Management, Vol. 15, No. 11, p. 22-24, November, 1973.

Descriptors: *Ohio, *Research, *Cattle, *Productivity, Farm wastes, Recycling, Protein, Feeds.
Identifiers: *Beef, Crossbreeding, Ralgro, Selenium, Shipping fever, Diethylstilbestrol.

Research on crossbreeding, wastes, protein, Ralgro, selenium and shipping fever has been conducted by animal scientists at the Ohio Agricultural Research and Development Center. The goal was to produce animals that manufacture many pounds of quality beef as quickly and efficiently as possible. A crossbreeding project was established in 1970 to help identify the importance of breeding alternatives. The mating scheme was designed to produce straightbred Angus and Charolais cow herds. Results showed Angus calves were smaller at birth, but had a higher rate of survival and higher conformation scores at weaning. They produced more pounds of calf per unit of metabolic size than any other crosses. Feeding animal wastes has potential in starter rations for fat cattle or in rations for brood cows or ewes. Feeding trials, including protein withdrawal, have proved animals to require supplemental protein until calves weigh between 760-790 lbs. Then supplement protein can be discontinued. Three trials involving 100 heifers and 300 steers showed the performance of DES-treated cattle. Blood analyses indicated the selenium content of whole blood was increased 56 days following selenium injection. Research is still being done on selenium injections. Smith and Preston revealed a theory that protein might be a factor in shipping fever; however, results of the study were inconclusive. (Drewry-East Central).

1393 - B1

REDUCING LABOR DURING BROILER GROWOUT

Extension Specialist for Broiler Production, Virginia Polytechnic Institute and State University, Blacksburg.
W. D. Weaver, Jr.
Poultry Digest, Vol. 32, No. 382, p. 538-540, December, 1973. 6 fig.

Descriptors: *Automation, *Litter, *Farm wastes, Labor, Cleaning, Virginia.
Identifiers: *Broiler growout, Spreading, Feeder lids, Water jugs.

Automation today probably has had a greater impact on how broilers are raised than any other segment of agriculture. In Virginia, observations were made on tasks such as getting new litter in and old litter out of the poultry house and on filling and cleaning feeder lids and water jugs. New litter is normally delivered to the house in trucks that can be automatically unloaded. Chain-bottomed trucks can spread the litter in a window through the center of the house. From experiments, it has been found that just as good a start can be obtained without water jugs, providing that at least four eight-foot shallow "V" water troughs are supplied per 1,000 birds. Filling feeder lids has not changed much during the past years and is still done by wheelbarrow and coal bucket. However, one grower in central Virginia used a motorcycle-powered cart. Because of the increasing cost of new litter material, most companies today are practicing a built-up litter program. Under this program, houses are cleaned out once a year. Clear span houses lend themselves best to automated cleanout, although houses with posts can be adapted to most automation. Remodeling can save labor when properly done. (Drewry-East Central).

1394 - C5, E2

SOIL COLUMNS FOR SIMULATING ANIMAL MANURE RECYCLING

Department of Agricultural Engineering, Macdonald Campus of McGill University, Ste. Anne de Bellevue 800, P.Q., Canada.
J. R. Ogilvie, and B. P. Warkentin.
Presented at 66th Annual Meeting, American Society of Agricultural Engineers, University of Kentucky, Lexington, June 17-20, 1973, Paper No. 73-429, 13 p. 4 fig, 2 tab, 7 ref.

Descriptors: *Farm wastes, *Recycling, *Soils, *Waste disposal, Denitrification, Degradation (Decomposition), Chemical properties, Physical properties, Biological properties, Microorganisms, Drainage, Water, Ions, Chromatography, Chemical oxygen demand.
Identifiers: *Soil columns, *Animal manure, Loading rates, Detention time, Flux.

Soil columns were used in two studies considering applications of carbonaceous slurry material for soil recycling. The soil columns were found to be useful guides to the effect of manure recycling on soils. Since microbial denitrification and degradation of the applied manure was desired, the study of detention time was of major importance, as was maximum loading of manure slurry. The study of the flux of different solutions through the soil was instrumental in deriving response curves for these experiments. (Frantz-East Central).

1395 - A5, A6, F2

LEGAL ASPECTS OF ODOR AND DUST FROM FEEDLOTS

Regional Extension Specialist, Feedlot Waste Management.
M. D. Paine.
Cattle Feeders' Information, 1972, p. 7451-7454.

Descriptors: *Legal aspects, *Odor, *Dust, *Feed lots, *Air pollution, *Regulation, Zoning.
Identifiers: *Nuisance laws, Site selection, Waste management, Licenses.

Because of the current emphasis on environmental quality, all businesses, including feedlots, will become more subject to pollution regulation. A feedlot is subject to both public and private regulation. Public regulation is conducted by most states through an agency to abate, prevent, and police air pollution. These "clean air commissions" have made their initial efforts in our major cities. Private influence on air pollution occurs through the so-called "nuisance" laws All persons have the basic right to enjoy their property. Any unreasonable interference with such enjoyment is legally a nuisance. In past nuisance cases, the complaining party has asked for: (1) An injunction, (2) Damages, (3) Both an injunction and damages. There are two types of nuisances—public and private. When a feedlot is run in such a manner as to disturb the rights of a large number of people, this is said to be a public nuisance. If the rights of only a few are disturbed, this constitutes a private nuisance. Selection of a remote site may be the most important thing a feedlot can do to avoid nuisance law suits. Feedlot operation in an area zoned for agriculture does not give absolute protection against nuisance lawsuits. There are three areas of pollution law affecting agriculture which may change in the future. These are: (1) A balancing of interest test used to determine the outcome of an injunctive action, (2) Expanding the concept of legal standing so that private citizens may, in the public interest, initiate actions against "polluters" and (3) A model act to regulate animal feeding operations. (Cartmell-East Central).

1396 - B1

BEEF CATTLE FEEDLOT SITE SELECTION FOR ENVIRONMENTAL PROTECTION

National Animal Feedlot Wastes Research Program, Robert S. Kerr Environmental Research Laboratory, Ada, Oklahoma.
R. D. Kreis, and L. R. Shuyler.
Environmental Protection Agency Report EPA-R2-72-129, November, 1972.

Descriptors: *Feed lots, *Sites, *Cattle, Farm wastes, Regulation, Topography, Soils, Odor, Agricultural runoff, Waste storage, Waste treatment, Waste disposal, Solid wastes, Slurries, Irrigation.
Identifiers: *Selection, *Environmental protection, Spatial requirements, Microclimates.

Considerations to be made when selecting a feedlot site fall into 6 categories—regulations, spatial requirements, topographic features, microclimates, soils and geologic structures, and social considerations. While application of good site selection principles is a matter of common sense and the ability to apply existing regulations, this report does give the feedlot operator some pointers on how to deal with site selection problems. Consulting engineers and government agencies are listed which may be utilized in solving unique site selection problems. (Cartmell-East Central).

1397 - B2, D4, E1

A BEEF CONFINEMENT BUILDING WITH AN OXIDATION DITCH

Assistant to the Director, Agricultural Experiment Station, University of Illinois, Urbana-Champaign.
D. B. Bauling, W. D. Boston, and D. L. Day.
Presented at 1973 Winter Meeting, American Society of Agricultural Engineers, Chicago, Illinois, December 11-14, 1973, 12 p. 10 fig.

Descriptors: *Confinement pens, *Oxidation lagoons, *Cattle, *Farm wastes, *Waste storage, Design, Foaming, Ammonia, Odor, Aeration.
Identifiers: *Recirculating system, Slotted-floor pens.

A new cold-confinement unit for beef cattle was placed in operation on November 30, 1972, at the beef Research Farm on the Urbana-Champaign Campus of the University of Illinois. The unit was designed to receive the animal waste, aerate it for odor control and decomposition, concentrate it for storage, and finally eliminate it from the system. The unit features a totally slotted floor, an oxidation ditch, a mechanically aerated settling lagoon, and an aerobic holding lagoon. All of these are tied together in a continuous recycling system designed to dispose of all the waste without the need to clean the oxidation ditch. The experiment has shown that removal or replacement of cattle, changes in animal diets, variations in dilution or aeration rates, and changes in temperature can all adversely affect the operation of the system. Design considerations, operational problems, and general observations are given. (Cartmell-East Central).

1398 - A2, A4, B2, E2

EFFECTS OF SPREADING MANURE ON GROUNDWATER AND SURFACE RUNOFF

Research Assistant, Department of Agricultural Engineering, University of Tennessee, Knoxville.
J. C. Barker, and J. I. Sewell.
Presented at the 1972 Annual Meeting, American Society of Agricultural Engineers, Hot Springs, Arkansas, June 27-30, 1972, Paper No. 72-203, 10 p. 4 tab.

Descriptors: *Farm wastes, *Agricultural runoff, *Groundwater, *Irrigation, *Waste disposal, Sampling, Biochemical oxygen demand, Dairy industry, Slurries, Physical properties, Bacteria, Nitrates, Nitrogen, Dissolved solids, Chloride.
Identifiers: *Manure, *Spreading, Saturation, Fecal coliform bacteria, Orthophosphate.

An experimental manure slurry irrigation system was established and the effects of the surface spreading of dairy manure slurry on surface runoff and groundwater quality were studied. Grab samples of surface and groundwater were collected on several dates between May 1971 and May 1972. Bacteriological analyses were performed on the samples for both total and fecal coliform bacteria. 5-day biochemical oxygen demand tests were conducted. The dissolved solids content of the filtered samples was determined, as well as nitrate nitrogen, orthophosphate, and chloride contents. Except for isolated cases, the bacterial and chemical concentrations of water samples from an area saturated with manure slurry were within the permissable criteria for raw water for public supplies. (Cartmell-East Central).

1399 - A4

FARM GROUND WATER NITRATE POLLUTION—A CASE STUDY

Illinois State Water Survey, Urbana-Champaign.
W. H. Walker, T. R. Peck, and W. D. Lembke.
ASCE Annual and National Environmental Engineering Meeting, Houston, Texas, October 16-22, 1972, 25 p. 8 fig. 13 ref.

Descriptors: *Groundwater pollution, *Nitrates, *Pollutant identification, *Wells, Chemical analysis, Aquifier, Septic tanks, Fertilizers, Soils, Sampling, Livestock.

A detailed study of the nature of groundwater nitrate pollution from farm-derived sources was carried out in Washington County, Illinois. Samples were taken and nitrate concentrations were expressed for different areas of the farmstead. Within the study area, 8 different nitrogen sources of pollution in the well could be identified and their effects evaluated. These were the septic tank, an old hog lot, inorganic farm fertilizer, an old chicken house, an old privy, an old horse barn and lot, an old cattle barn and lot, and nitrate fallout. As was illustrated in this study, wells located down gradient and within the flow path of nitrates or similar chemical pollution sources eventually will be adversely affected even though several years may be required for the pollution to move through the aquifer from the source to the well. (Cartmell-East Central).

1400 - A1

EFFECT OF CATTLE FEEDLOT VOLATILES, ALIPHATIC AMINES, ON CHLORELLA ELLIPSOIDEA GROWTH

United States Department of Agriculture, Ft. Collins, Colorado.
A. R. Mosier.
JOURNAL OF ENVIRONMENTAL QUALITY, Vol. 3, No. 1, p. 26-28, January-March, 1974, 1 fig, 3 tab, 10 ref.

Descriptors: *Feed lots, *Volatility, Algae, Toxicity, Nitrogen, Ammonia.
Identifiers: *Aliphatic amines, *Chlorella, Ellipsoidea.

The purpose of this study was to determine the effect of individual aliphatic amines that have been identified as feedlot volatiles on chlorella ellipsoidea. The amines tested were methyl, dimethyl, ethyl, diethyl, n-propyl, iso-propyl, n-butyl, and sec-butyl. Individual aliphatic amines caused a 50% reduction in population growth of chlorella ellipsoidea at concentrations ranging from 1.2 to 143 ppm amine-N. The more closely the amine structurally resembles ammonia, the greater thee inhibitory effect. The primary amines were more toxic than the sec-, iso-, or the dialkylamines. The algae could not utilize any of the amines as N sources either in the presence of adequate N or under N-deficient conditions. (Cartmell-East Central).

1401 - E2, F2

THREE TONS IS ALL YOU GET

WESTERN DAIRY JOURNAL, Vol. 29, No. 8, p. 12-13, June, 1973. 2 fig.

Descriptors: *Farm wastes, *Dairy industry, *Waste disposal, *Legal aspects, Cattle, Costs, Water Quality Control, Transportation.
Identifiers: *Manure.

A decision by California's Santa Ana Regional Water Quality Control Board states: The discharge of manure waste to lands owned or controlled by the discharger (dairyman) shall not exceed three tons (dry weight) per acre per year. The amount figures to the equivalent of 1.5 times the amount of manure produced by one cow in one year. The dairymen assume that if they can't put the manure on their own property, they must haul it away. But transportation and a place to haul it will be a problem. Also, the decision raises costs and could prevent dairymen from expanding herds to pay for those increases. The newest order requires dairymen to report any increase in the number of animals by 25% or 100 head-whichever is smaller. (Cartmell-East Central).

1402 - A5, B1

EFFECT OF WASTE MANAGEMENT AND EGG PROCESSING ON THE FLAVOR OF COOKED EGGS

Department of Poultry Science, Cornell University, Ithaca, New York.
K. R. Nath, J. M. Darfler, and R. C. Baker.
POULTRY SCIENCE, Vol. 52, No. 3, p. 1178-1185, May, 1973. 3 fig, 6 tab, 9 ref.

Descriptors: *Farm wastes, *Poultry, *Environment, Hydrogen Sulfide, Odor.
Identifiers: *Eggs, *Flavor, *Processing, *Waste management, Cryovac bags, Egg storage, Albumen, Yolk.

Four different chambers used for handling manure were compared in a study undertaken to evaluate the effect of environmental odors on the flavor of soft cooked eggs. Soft cooked eggs were prepared by immersing eggs in boiling water for four minutes. Hard cooked eggs were prepared by heating eggs for 20 minutes in water at 93°C. Some hard cooked eggs were stored in shells while other were peeled and packaged in Cryovac bags. All storage studies were done at 5°C. Hen-house environment has no effect on the flavor of soft cooked eggs. In hard cooked eggs, the flavor quality of both albumen and yolk deteriorated at one week. When eggs were peeled and packaged in Cryovac bags albumen did not deteriorate as rapidly as eggs stored in shells. The loss of H_2S from cooked eggs is responsible for the loss of egg flavor. (Cartmell-East Central).

1403 - B1, D1, E1, E3, F4

SUMMARY OF SYMPOSIUM ON CONVERSION OF POULTRY WASTE

In: Summary of Symposium on Conversion of Poultry Waste, Lancaster Farm & Home Center, Lancaster, Pennsylvania, November 10, 1971, 60 p.

Descriptors: *Farm wastes, *Poultry, *Waste disposal, *Waste treatment, Dehydration, Recycling.
Identifiers: Conversion.

These papers were concerned with poultry manure waste management and disposal. The benefits of drying poultry manure and the potential of poultry manure recycling were explored. It was determined that a great deal of research and field testing is needed to fully develop the process of poultry waste conversion so that new products can be used, marketed or safely discharged into our environment. (Merryman-East Central).

1404 - B3, D1, E2, E3

24 MILLION POUNDS OF OPPORTUNITY

Cloisterdale Farms, Incorporated, Ephrata, Pennsylvania.
G. Herr.
Summary of Symposium on Conversion of Poultry Waste, Lancaster Farm & Home Center, Lancaster, Pennsylvania, November 10, 1971, 14 p. 1 fig.

Descriptors: *Farm wastes, *Waste disposal, *Recycling, *Waste treatment, Poultry, Cattle, Hogs, Lagoons, Odor, Fertilizer, Irrigation, Dehydration, Incineration, Costs.
Identifiers: *Shud, *Agri-business, Composting, Pollution, Land spreading, Semi-dry waste, Refeeding, Community Relations.

Agri-waste not only is a problem to our environment, it also is a huge untapped resource. Many problems stand in the way of utilization of this resource, but if everyone works together, pollution caused by waste can be lessened and waste can be used beneficially. Experiments at Cloisterdale Farms have indicated that even large operations can handle their waste by gradually converting waste to semi-dry; thus reducing waste moisture to 28-35%. Odor free semi-dry waste can then be hauled off and spread on land. Also, possible dehydraation might lend to fertiliser products, re-feeding, composting or other uses of waste. Conclusions indicate that liquid handling; be it lagoon, irrigation or hauling would not be the long range answer to disposal problems. Getting rid of the waste is not just a problem; getting rid of it profitably is an opportunity. (Russell-East Central).

1405 - A5, B3, D2, F1

MANURE REDUCTION AND CONVERSION METHODS OF THE FUTURE

Department of Poultry Science, Pennsilvania State University, University Park, Pennsylvania.
G. O. Bressler.
Summary of Symposium on Conversion of Poultry Waste, Lancaster Farm & Home Center, Lancaster, Pennsylvania, November 10, 1971, 4 p.

Descriptors: *Farm wastes, *Dehydration, *Waste treatment, *Poultry, Drying, Environment, Anaerobic bacteria, Odor.
Identifiers: Manure, Drying pits.

Pennsylvania State researchers have been investigating dehydration of manure as an economic solution to waste problems and have developed a two-stage drying system. In stage one, the use of high velocity air movement and mechanical stirring of the manure in the pit reduces each 2.9 tons of manure to 1 ton, a reduction of about 3 to 1. The resulting manure can be easily transported with a minimum of odors. Stage two dries the remaining manure in a dryer to a moisture level of about ten percent. The result is a fine, dry manure product, free from offensive odors and able to be stored without deterioration or odor formation. Dehydration offers the best hope for the future. Not only does this method have the advantage of reducing the quantity of material and offensive odors, its influence on improvement of the poultry house environment may show additional benefits. Working conditions for the caretaker would also be improved. These advantages may very well off-set some of the costs of handling manure by the dehydration method. (Russell-East Central).

1406 - B1, D1, E1, F4

ECONOMICS OF MANURE HANDLING

Department of Agricultural Economics, Pennsylvania State University, University Park.
A. P. Stemberger.
Summary of Symposium on Conversion of Poultry Waste, Lancaster Farm & Home Center, Lancaster, Pennsylvia, November 10, 1971, 1 p.

Descriptors: *Farm wastes, *Poultry, *Conversion, Waste disposal, Cost analysis.
Identifiers: *Waste management.

Data was collected by personal interview of managers of egg production enterprises and by observation of operations whenever possible. Information was collected regarding type of waste disposal systems used, investment necessary, operating costs, labor required, odor and insect problems, methods and frequencey of manure removal and disposal, size of operation and performance of layers. This information is being analyzed to determine costs of handling and removing manure from egg laying houses by various methods. An investigation of costs of methods of processing raw manure into saleable products, size of market, and estimation of demand for poultry manure products is being conducted. The objective is to determine manure handling costs for various systems. Naturally, the industry is interested in methods with the least cost. But, they also realize that the least-cost system of handling manure may not always be the best one. They are striving to find a system that does not affect layer performance and produces a desired saleable end product. After careful study of specific operations, results will have to be used with caution. (Russell-East Central).

1407 - A5, B3, D2, E2, E3, F1

MODIFY YOUR POULTRY HOUSE FOR MANURE DRYING

Poultry Science Extension, Pennsylvania State University, University Park.
F. W. Hicks.
Summary of Symposium on Conversion of Poultry Waste, Lancaster Farm & Home Center, Lancaster, Pennsylvania, November 10, 1971, 6 p.

Descriptors: *Modification, *Farm wastes, Poultry, Drying, Dehydration, Waste treatment, Waste disposal, Odor, Ventilation, Air conditioning, Environmental control, Lagoons, Aerobic bacteria, Anaerobic bacteria.
Identifiers: *Poultry house, *Manure, *In-house drying.

A lot of material is being written about efficient and practical waste handling, but no one has devised the system which could be considered the final answer to poultry housing and waste management. It seems that drying or dehyration is the best answer, and one easily utilized drying method is from the ventilation system within the poultry house. The partially dried waste could then be spread on land, allowed to be broken down by bacteria, or stored. In-house drying also reduces odors significantly, and usually very little house modification is necessary. No matter what type of waste handling system is used, it must be: (1) Socially acceptable to neighbors, (2) Economically feasible and practical, (3) Mechanically possible and simple, (4) Legal according to local and federal regulation. If at all possible, waste should be disposed of in such a way that it may be recycled to avoid a drain on natural resources. (Russell-East Central).

1408 - B1, E3, F1

THE ECONOMICS OF RECYCLING CONVERTED POULTRY WASTE THROUGH CATTLE

Department of Animal Science, Pennsylvania State University, University Park.
T. L. Long.
Summary of Symposium on Conversion of Poultry Waste, Lancaster Farm & Home Center, Lancaster, Pennsylvania, November 10, 1971, 6 p. 2 tab.

Descriptors: **Farm wastes, *Poultry, *Economics, *Recycling, *Waste disposal, Litter, Organic matter, Proteins
Identifiers: *Wastelage, *Refeeding, Ensilage.

Experiments have shown that poultry manure and litter fed to cattle as part of a balanced ration can give satisfactory results. Poultry waste is especially good as a protein supplement for ruminants, because rumen microorganisms are able to utilize the nitrogenous compounds of the manure and synthetize bacterial protein which can then be utilized by the host animal. Many factors favor use of poultry waste as a feed. It would be an economic and efficient use of a huge resource and would remove the large problem of waste management. Experiments were conducted on Hereford steers to evaluate nutritional and economic feasibility of using fresh poultry excreta as a major component of wastelage. Three growing rations calculated to support 1.65 pounds of body weight gain per day were devised and cost per hundred pounds of gain calculated. When results were tabulated, it was found that while all rations gave economical gains, it would have cost about 45% less per hundred pounds gain when the cattle were fed corn wastelage as compared to alfalfa hay. (Russell-East Central).

1409 - B3, D2, E3

SOME POTENTIAL USES FOR DEHYDRATED POULTRY WASTES,

Poultry Science Extension, Pennsylvania State University, University Park.
O. D. Keene,
Summary of Symposium on Conversion of Poultry Waste, Lancaster Farm & Home Center, Lancaster, Pennsylvania, November 10, 1971, 11 p. 4 tab, 15 ref.

Descriptors: *Farm wastes, *Poultry, *Dehydration, *Recycling, *Waste treatment, *Waste disposal, Nutrition, Nitrogen, Proteins, Ruminants, Bacteria, Insects.
Identifiers: *Refeeding, Uric acid, Environmental protection.

Disposing of poultry waste is a problem which is increasing in magnitude. Recycling as feed offers promising results to researchers. Inclusion of poultry manure into diets of ruminants has been reported by many investigators, and ruminants apparently can use many of the ingredients found in poultry wastes. However, incorporation of manure into the diets of poultry has had limited success. The major basis for this is uric acid. Uric acid apparently is detrimental to poultry by acting as an irritant in the intestinal tract. Due to experiments, it seems apparent that refeeding poultry manure back into poultry has very limited possibilities. Research into other areas of disposal is also being conducted. Insect disposal of waste is one possibility, but much study needs to be done before we engage in large scale use of insects. Also bacterial fermentation is a possible avenue for disposal. No matter what the method there will be problems, but perhaps a feasible working solution will result from further research and study. (Russell - East Central)

1410 - B1, D1, E1, F2, F3

LIVESTOCK WASTE MANAGEMENT SYSTEM DESIGN CONFERENCE FOR CONSULTING AND SCS ENGINEERS,

Livestock Waste Management System Design Conference for Consulting and SCS Engineers, Lincoln, Nebraska, February 15-16, 1973, 303 p.

Descriptors: *Livestock, *Design criteria, *Engineering, Legal aspects, Farm wastes, Waste treatment, Waste disposal, Agricultural runoff.
Identifiers: *Waste management, pollution.

This conference was conducted in order to bring together those concerned with feedlot waste storage, treatment and disposal systems. Actual USDA-SCS guides drawn to Nebraska engineering standards and specifications for livestock waste control were included. (Marquard-East Central)

1411 - B1, F2

RULES AND REGULATIONS PERTAINING TO LIVESTOCK WASTE CONTROL,

Presented at Livestock Waste Management System Design Conference for Consulting and SCS Engineers, Lincoln, Nebraska, February 15-16, 1973, 13 p.

Descriptors: *Regulation, *Legal aspects, *Livestock, *Waste treatment, *Waste disposal, Nebraska, Farm wastes, Permits, Groundwater, Water pollution.
Identifiers: *Rules, Registered municipal wells.

Nebraska rules and regulations concerning livestock waste control are delineated. Pertinent terms are defined; permit requirements are outlined; and requirements for livestock waste control facilities are given. A list of the registered municipal wells in Nebraska is included. Also listed, are the towns that have been issued permits to withdraw and use groundwater. (Marquard-East Central).

1412 - A2, B2

HYDROLOGIC AND HYDRAULIC CONSIDERATIONS FOR DESIGN OF LIVESTOCK WASTE MANAGEMENT SYSTEMS,

United States Department of Agriculture Lincoln, Nebraska.
N. P. Swanson.
Presented at Livestock Waste Management System Design Conference for Consulting and SCS Engineers, Lincoln, Nebraska, February 15-16, 1973, 18 p. 2 fig. 1 tab, 26 ref.

Descriptors: *Livestock, *Design, *Farm wastes, *Agricultural runoff, Feed lots, Waste storage, Odor, Terracing, Nitrates, Rain, Slope, Solid wastes, Nebraska.
Identifiers: Waste management systems.

A discussion is given on hydrologic factors which are pertinent to potential pollution from feedlots. Experiments with a rainfall simulator produced solids losses as high as 10.7 and 27.9 tons per acre foot of runoff on an 8.5 percent slope. 13% slopes produced as high as 40.5 to 66 tons of solids per acre foot. Snowmelt causes a higher concentration of suspended solids. Solids transported by runoff and collected in a holding pond pose three problems: (1) pond storage capacity is reduced (2) emptying the pond by pumping is more difficult and (3) accumulation of solids causes odors. These problems may be overcome by terracing and lowering of slope. (Marquard - East Central)

1413 - A2, B2

FEEDLOT RUNOFF CONTROL SYSTEM DESIGN AND INSTALLATION—A CASE STUDY

Agricultural Research Service
United States Department of Agriculture
Agricultural Engineering Research Division
University of Nebraska, Lincoln
C. B. Gilbertson, and J. A. Nienaber.
Presented at Livestock Waste Management System Design Conference for Consulting and SCS Engineers, Lincoln, Nebraska, February 15-15, 1973, 16 p. 4 fig. 3 tab, 19 ref.

Descriptors: *Agricultural runoff, *Feedlots, *Control systems, *Design, *Installation, Water pollution, Farm wastes, Cattle, Waste treatment, Waste storage, Waste disposal, Continuous flow, Settling basins, Solid wastes, Nebraska.
Identifiers: *Debris basin, *Holding pond, Settleable solids,

A case study was made for a 1000-head beef feedlot for the design and installation of a debris basin, holding pond and disposal area for controlling runoff. Design equations were formulated. The continuous flow system removed solids successfully in the debris basin. Solids transported by snowmelt and rainfall were 2.6 and 1.8 tons per acre respectively. The debris basin removed 50% of these solids. Problems of wood board swelling developed with the discharge control from the debris basin to the holding pond. The use of tile will prevent this problem. It is recommended that the holding pond capacity be increased to 100% of the ten-year twenty-four hour storm when the feedlot represents a high pollution threat to the surrounding area. (Marquard - East Central).

1414 - B2, E2

SPRINKLER APPLICATION OF LIQUID WASTES FROM HOLDING PONDS,

Howard Wittmuss
Presented at Livestock Waste Management System Design Conference for Consulting and SCS Engineers, Lincoln, Nebraska, February 15-16, 1973, 7 p. 4 tab.

Descriptors: *Waste disposal, *Liquid wastes, Chemical properties, Nitrogen, Effluent, Cattle, Feed lots, Fertilizers, Phosphorus, Nebraska.
Identifiers: *Holding ponds, *Sprinkler applications, Chlorine.

A research study concerning disposal of liquid wastes was conducted at Nebraska's Mead Field Laboratory. The study included three replications each of effluent application, fresh water application and a check (no water application) in sod planted corn. One half of each plot received 200 pounds of nitrogen fertilizer as ammonium nitrate and the other half was unfertilized. The effluent and water were applied at a graded rate from 1 inch to 3 inch applications on the same plot area. Soil moisture, soil density, soil chemical analysis, effluent analysis, deep percolate analysis, crop yield, and crop chemical analysis data was collected during the year. Results indicated that effluent could be disposed of in corn fields by sprinkler at a rate of 10 inches a year for maximum benefit from the effluent. (Merryman - East Central).

1415 - A1, B1, D1, E1, F4

HOW TO GUARD AGAINST POLLUTION FROM BEEF CATTLE FEEDLOT WASTES,

United States Department of Agriculture
Lincoln, Nebraska
T. M. McCalla, and G. E. Schuman
Presented at Livestock Waste Management System Design Conference for Consulting and SCS Engineers, Lincoln, Nebraska, February 15-16, 1973, 9 p. 4 tab, 19 ref.

Descriptors: *Farm wastes, *Cattle, *Water pollution, *Agricultural runoff, *Feed lots, Groundwater pollution, Waste treatment, Waste disposal, Nitrogen, Odor, Nebraska.
Identifiers: *Pollution, Effluent application, Waste management.

A description is given for the factors involved in water pollution from feedlots. A literature survey covers the topics of runoff, groundwater pollution, effluent application, feedlot management, odors, land utilization, housed feed lots and microbial pollution. It was concluded that no matter what waste management design is used, management of the system is the key factor. The less maintenance or attention required by the feeder, the better. (Marquard-East Central).

1416 - B2, D4, F2

DAIRY AND SWINE WASTE SYSTEMS

E. A. Olson
Presented at Livestock Waste Management System Design Conference for Consulting and SCS Engineers, Lincoln, Nebraska, February 15-16, 1973, 6 p. 3 fig.

Descriptors: *Farm wastes, *Dairy industry, *Cattle, *Hogs, *Waste treatment, *Waste disposal, Septic tanks, Agricultural runoff, Design, Design criteria, Nebraska.
Identifiers: *Waste systems, *Waste management, Holding pond.

Three systems are given for handling dairy wastes. System A takes milkroom and toilet wastes to an aerobic lagoon. The lagoon size should be five feet deep and have 50-60 square feet of surface area per cow. A holding pond is used to collect runoff from the lot. In system B, all wastes except washroom and toilet go to a holding pond. The holding pond is emptied as required. The washroom and toilet wastes go to a septic tank and then field disposal. System C is the same as B except it replaces the holding pond with a closed storage tank which has a 120 day storage capacity. Regardless of disposal method, the dairyman must have his plans approved by the Bureau of Dairies and Foods to keep a Grade A dairy standing. Swine wastes can be handled in the same manner. Holding pond capacity should be 34.5 cubic feet per hog. (Marquard - East Central).

1417 - B1, D4, E2

LIVESTOCK WASTE MANAGEMENT SYSTEMS—MANAGEMENT AND MAINTENANCE DESIGN CONSIDERATIONS

United States Department of Agriculture, Lincoln, Nebraska.
N. P. Swanson and L. G. Jackson,
Livestock Waste Management System Design Conference for Consulting and SCS Engineers, Lincoln, Nebraska, February 15-16, 1973, 6 p.

Descriptors: *Livestock, *Cattle, *Management, *Maintenance, *Design, *Feed lots, Agricultural runoff, Solid wastes, Liquid wastes, Irrigation systems, Nebraska, Waste storage, Waste treatment, Waste disposal, Effluent.
Identifiers: *Waste management, Pollution.

In order to properly maintain a feedlot, one must include planning for emergencies. There should be a means of feeding the cattle and cleaning the feedlot during inclement weather. The feedlot holding pond should have enough capacity to hold a 10-year storm. For solid waste management, land application for manure is an acceptable practice. Application rates should be based on soils, crops, and cultural practices. 1.5 tons of manure per animal per year can be expected. Mounding may be used to dispose of solids and to improve bedding areas for cattle. Debris basins provide solid waste storage, but must be cleaned when accumulations reach 6 to 8 inches. For liquid waste disposal, irrigation is the only method now recommended in Nebraska. 10 inches of runoff per year can be expected in Nebraska and may be applied by flooding, furrow or sprinkler irrigation. (Marquard - East Central).

1418 - A2, B2

TYPICAL AND UNIQUE DISPOSAL SYSTEMS SURFACE DRAINAGE

United States Department of Agriculture, Lincoln, Nebraska.
N. P. Swanson.
Livestock Waste Management System Design Conference for Consulting and SCS Engineers, Lincoln, Nebraska, February 15-16, 1973, 2 p. 1 fig.

Descriptors: *Farm wastes, *Waste disposal, *Feed lots, *Surface drainage, Agricultural runoff, Slopes, Groundwater pollution, Waste storage, Drainage, Basins, Nebraska.
Identifiers: Mounding.

Surface drainage on a level feedlot is a constant problem. Manure accumulation at T. C. Reeves farm had reached 12 to 15 inches and was causing problems. To solve the problem, mounds were constructed and a moderate slope was built into drainways between the mounds. The drainage was passed on to three shallow basins which were connected by underground lines to a sump. Due to possible groundwater pollution, the runoff was pumped from the sump to an underground polyethylene-lined holding pond. Heavy rains in the summer of 1972 and a wet winter have proven the value of this drainage system. (Marquard - East Central),

1419 - A2, B2, E2

RUNOFF CONTROL FOR A CREEK BANK FEEDLOT

United States Department of Agriculture
Lincoln, Nebraska
N. P. Swanson
Livestock Waste Management System Design Conference for Consulting and SCS Engineers, Lincoln, Nebraska.

Descriptors: *Livestock, *Farm wastes, Waste treatment, Waste disposal, Legal aspects, Nebraska.
Identifiers: *Waste control facilities, *Guidelines, Permits, Pollution, Soil Conservation Service, Nebraska Department of Environmental Control.

Unless it is controlled, runoff from a feedlot on a flood plain or creek bank is a potential source of pollution. However, many times relocation of the feedlot by the owner is not feasible. One feedlot owner met this pollution problem by installing a ten foot high dike along the lower side of the feedlot next to the creek. The dike prevented runoff contamination of the water and flooding of the creek. It also provided comfort for the animals. Runoff from the feedlot was collected in a basin. Three riser inlets drained the basin into a sump. From there, the water was pumped to a holding pond from which it is spread as irrigation water to field crops. (Marquard-East Central).

ABSTRACTS

1420 - B1, F2

GUIDELINES ON LIVESTOCK WASTE CONTROL FACILITIES

Nebraska Department of Environmental Control, Lincoln
Livestock Waste Management Design Conference for Consulting and SCS Engineers, Lincoln, Nebraska, February 15-16, 1973, 12 p.

Descriptors: *Livestock, *Farm wastes, Waste treatment, Waste disposal, Legal aspects, Nebraska.
Identifiers: *Waste control facilities, *Guidelines, Permits, Pollution, Soil Conservation Service, Nebraska Department of Environmental Control.

The steps required for obtaining a permit for livestock operations where pollution potential exists are given. Basically, the operator must first request a permit:. The Department of Environmental Control then makes an inspection. If no controls are needed the permit is issued. If controls are needed, the Soil Conservation Service engineers design the controls and the operator places them into operation. Then the permit is issued. Samples of the forms to be filled out are included. (Marquard-East Central).

1421 - B1, F4

COORDINATED LIVESTOCK PRODUCTION SYSTEMS

United States Department of Agriculture, Lincoln, Nebraska.
N. C. Teter, and C. B. Gilbertson.
Livestock Waste Management System Design Conference for Consulting and SCS Engineers, Lincoln, Nebraska, February 15-16, 1973, 10 p, 4 tab.

Descriptors: *Livestock, Farm wastes, Cattle, Hogs, Waste disposal, Design criteria, Feeds, Waste storage, Lagoons, Odor, Irrigation systems, Performance.
Identifiers: *Coordinated production systems, Water systems, Electrical power systems.

This paper discusses the components necessary for designing a complete livestock production unit. Specific publications are recommended which will aid in designing water systems, feeding systems, and waste management systems. All variables should be coordinated in order to create a total system that is easy to manage. Even the best designed system will fail if it is not properly managed. (Marquard-East Central).

1422 - B1, F4

AN ANALYSIS OF BEEF CATTLE FEEDLOT DESIGNS FOR POLLUTION CONTROL

Agricultural Engineering Research Division, Agricultural Research Service, Lincoln, Nebraska.
C. B. Gilbertson.
Livestock Waste Management System Design Conference and SCS Engineers, Lincoln, Nebraska, February 15-16, 1973, 8 p. 2 tab. 6 ref.

Descriptors: *Feed lots, *Design, *Analysis, *Waste treatment, *Waste disposal, Farm wastes, Costs, Odor, Oxidation lagoons, Water pollution, Design Agricultural runoff, Incineration.
Identifiers: *Pollution control, Mounding, Paved feedlots, Unpaved feedlots, Housed feedlots, Composting.

Feedlot waste management alternatives of paved, unpaved and housed feedlots are discussed. Alternatives which are listed are mounding, composting, incineration, oxidation ditches and mechanical scraping. The physical requirements for each system are given. The method to be used will vary considerably with the cattle density; however, these observations can be made: (1) odor problems will limit outdoor feedlots in the future, (2) high labor costs and discomfort to cattle will limit development of paved feedlots, (3) housed feedlots will increase in the future due to high labor cost and pollution problems of outdoor feedlots, (4) for a housed feedlot unit, the costs of structure is about 50% of the total materials costs, and (5) use of oxidation ditches with housed feedlots will increase materials' costs by 17 to 20%. (Marquard-East Central).

1423 - A2, A4, A9, C1, D1

AFLATOXIN FORMATION IN STERILIZED FEEDLOT MANURE AND FATE DURING SIMULATED WATER TREATMENT PROCEDURES

Department of Microbiology
Colorado State University
Ft. Collins
D. A. Hendrickson, and D. W. Grant.
Bulletin of Environmental Contamination and Toxicology, Vol. 6, p. 525-531, November-December, 1971. 2 tab. 7 ref.

Descriptors: *Farm wastes, *Water treatment, *Feed lots, *Water pollution, *Groundwater pollution, Agricultural runoff, Microorganisms, Toxicity, Cattle, Decomposing organic matter, temperature.
Identifiers: *Aflatoxin, Sand filtration, Chlorination.

A study was undertaken to: evaluate cattle feedlot manure during various stages of decomposition as a substrate for aflatoxin formation of surface and ground water supplies; and determine the fate of the aflatoxin during simulated water treatment procedures. It was found that 0.2 mg per kg of aflatoxin B was formed in fresh and partially decayed manure, while only 0.01 mg per kg was formed in stockpiled manure. Similarly, aflatoxin G was found in small amounts in the partially decayed manure and was absent from the stockpiled manure. The lowest temperature permitting aflatoxin formation in autoclaved fresh manure was 10 to 15 C, while the upper limit was 37 to 41 C. It is concluded that fungal growth and toxin formation in decomposing manure are naturally modified by the growth of a varied microflora, although under proper conditions stockpiled feedlot wastes may serve as substrates for aflatoxin formation. Therefore, it is likely that the aflatoxins formed in the wastes could, via runoff and leaching, contaminate water destined for domestic use, thereby necessitating the application of precautionary decontamination measures. Both sand filtration and chlorination of aflatoxin-contaminated water were found effective in removing or inactivating the contaminants, and the application of one or both during all water treatment processes is recommended. (Solid Waste Information Retrieval System).

1424 - A2, B2, C2

BEEF CATTLE FEEDLOT RUNOFF—PHYSICAL PROPERTIES

Agricultural Research Service, United States Department of Agriculture, Nebraska University, Lincoln.
C. B. Gilbertson, and J. A. Nienaber.
Transactions of the ASAE, Vol. 16, No. 5, p. 997-1001, Sept.-Oct., 1973, 3 fig., 7 tab., 13 ref.

Descriptors: *Agricultural Runoff, *Feed lots, *Cattle, *Farm wastes, *Physical properties, Chemical properties, Sampling.
Identifiers: *Runoff control, Solids.

This paper represents basic information of feedlot runoff for enhancing and simplifying design of runoff control facilities. Three runoff control facilities were constructed and instrumented on feedlots with a capacity of 200 head each. Two additional runoff control facilities were installed with 1000-head capacity. Automatic runoff samplers were installed on all sites to obtain composite samples of runoff from the feedlots and on effluent discharged from the debris basins to the holding ponds. Laboratory analyses were run and total solids concentration, settleable solids, and nonfiltrable solids were determined. These data may be valuable in calculating detention times and storage capacities for solids settling facility design. The results can also be used to calculate solids accumulations in holding ponds to estimate maintenance requirements. (Cartmell-East Central).

1425 - B1

AN ANNOTATED BIBLIOGRAPHY OF FARM ANIMAL WASTE MANAGEMENT

Water Pollution Control Directorate
Environmental Protection Service
J. B. McQuitty, and E. M. Barber.
Environmental Protection Service Report Number EPS 3-WP-72-1, December, 1972, 522 p.

Descriptors: *Farm wastes, *Bibliography.

This monumental volume contains 2352 abstracts of material which appeared (with very few exceptions) between 1960 and 1971. The classifications adopted and the number of abstracts in each class is as follows:

A.	Abstracting journals and bibliographies	641
B.	Scientific and technical journals	678
C.	Conference proceedings	351
D.	Books and monographs	58
E.	Government, research center, and university publications	318
F.	Semi-technical publications	110
G.	Unpublished scientific and technical papers	196

(Whetstone, Parker, & Wells-EPA)

1426 - D1, E2

INDUSTRIAL WASTES - RESEARCH AND PRACTICE IN ANIMAL WASTES TREATMENT

Tippecanoe Laboratries
Eli Lilly & Co.
Lafayette, Indiana
R. H. L. Howe
Water & Wastes Engineering, Vol. 6, No. 1, p. A14-A18, January 1969. 7 fig. 7 tab, 6 ref.

Descriptors: *Farm wastes, *Waste treatment, *Water pollution, On-site investigations, Chemical properties, Physical properties, Waste disposal, Livestock, Biological treatment, Liquid wastes, Solid wastes.
Identifiers: *Animal processing wastes, Slaughterhouse.

To investigate animal wastes problems, it is necessary to determine the quantity of wastes produced by each animal and the important characteristics of the wastes. Charts are furnished to show the composition and characteristics of animal, human, slaughterhouse and packinghouse wastes. Once the quantity and characteristics are established, effective and economical methods can be developed to serve industries and to help reduce the water pollution load caused by animal production. It has been found that solid wastes and liquid wastes must be separated and handled differently for reasons of economy. The liquid wastes are collected and treated by aerobic oxidation, biological adsorption, and flocculation followed by clarification and filtration. In one case, a three stage biological treatment is required for stabilizing the liquid. The merits of this system are: low cost, minimum operation with flexible capacity and control, maximum safety, and high efficiency. The treated effluent can be used for irrigation and other agricultural or industrial purposes. Physical and chemical methods of animal wastes treatment are also being investigated. The treatment of animal processing wastes involves the following steps: separation of suspended solids and grease from the liquid; chemical coagulation and clarification of the clarified liquid; and chlorination and oxygenation of the final treated effluent. The processes are discussed in detail. (Solid Waste Information Retrieval System).

1427 - B3, D1, E1

THE SOCIAL REDEMPTION OF PURE GARBAGE

J. Solomon
Sciences, Vol. 12, No. 6, p. 13-15, July-August, 1972.

Descriptors: *Reclamation, *Wastes, California, Anaerobic digestion, Methane, Fuels, Gasses
Identifiers: *Garbage, *Pollution, Chlorine, Sulfur

Intriguing possibilities for converting garbage into fuel are outlined. If garbage were efficiently converted to power, it could furnish up to 6 percent of total U. S. energy needs. Each pound of garbage can supply 3,000 to 6,000 BTU of heat. One company fed pulverized refuse into a power generating station. Waste provides 10 percent of the energy fired. In another process, solid waste is reduced in size and fed to a pressurized, fluidized bed combuster. Hot gasses are cleaned of particulates and passed through a gas turbine to produce electricity. In both cases, however, chlorine produced in the off-gasses is a potential pollutant. A corporation in California is attempting to produce oil, fuel gas, and solid char by exposing solid waste to iron removal processes, air classification, shredding,, and pyrolysis. Another firm reacts solid waste with carbon monoxide in the presence of sodium carbonate to yield low-sulfur fuel. If all of the nation's animal wastes were treated by anaerobic digestion, half of the current methane consumption would be produced. (Solid Waste Information Retrieval System)

1428 - B1, D1, E2, E3

RECYCLE ORGANIC WASTES AS FEED FOR MEAT ANIMALS

Compost Science, Vol. 12, No. 6, p. 19, November-December, 1971.

Descriptors: *Waste disposal, *Recycling, *Farm wastes, *Organic wastes, *Feeds, Livestock, Nutrients, Sawdust, Fertilizers
Identifiers: Meat

Zoologists at Penn State University have been experimenting with feeding farm animals on several forms of organic wastes, most of which are of nutritional value. When adequately supplemented with protein, vitamins and minerals, wastes can serve as excellent animal feeds as well as easing disposal problems in a manner which is more economically feasible than is spreading them on fields as a fertilizer. Now that DDT is no longer used on orchard trees, apple pomace should be fed to ruminants, for whom it is a satisfactory energy source. Ground waste paper soaked in blackstrap molasses was readily eaten by ruminants, as was sawdust, a roughage substitute which seems to contribute to lower rates of liver abscesses. Finishing rations containing sterilized poultry wastes had no effect on weight gain, meat, carcass quality, or any other factors under study. None of these feeds produced unacceptable levels of arsenic, chlorinated hydrocarbons, or pesticides in meat, fat, or liver tissue. Although consumer acceptance is one stumbling block to such a feed program the technology for this form of waste utilization is already available. (Solid Waste Information Retrieval System)

1429 - B2, D4, E2, E4

IN-THE-BUILDING OXIDATION DITCHES FOR LIVESTOCK WASTES

Agricultural Engineering Department
Illinois University
Urbana-Champaign
D. L. Day
Water & Wastes Engineering, Vol. 7, No. 9, p. E-23-E-24, September 1970.

Descriptors: *Farm wastes, *Livestock, *Waste treatment, Aerobic treatment, Effluents, Nitrates, Biochemical oxygen demand, Odor, Phosphates, Lagoons, Waste storage, Waste disposal
Identifiers: In-the-building oxidation ditches, Biological oxidation, Land disposal

Aerobic treatment for the removal of biodegradable organic matter from liquid wastes is an odorless process consisting of two phases operating simultaneously. One phase is biological oxidation that gives by-products such as carbon dioxide and water, and yields energy. The second phase utilizes the energy from the oxidation for synthesis of new cells. The in-the-building ditch for livestock wastes is a completely mixed aerobic system having a long detention time. The ditch is located beneath the self-cleaning slotted floors in a confinement building. The liquid volume is about 30 cu ft/pound of daily BOD5. The liquid is shallow to keep the solids suspended. The depth is kept constant by using an overflow for the mixed liquor. After the bioxidation system comes to equilibrium, the mixed liquor BOD5 will typically be 3,000 to 5,000 mg/L, resulting in a BOD5 reduction of about 90 percent. A low-labor waste treatment system can be formed by allowing the oxidation ditch liquor to overflow by gravity into a non-overflow aerobic lagoon with a fluctuating depth. The effluent is not suitable for direct discharge into a stream, but may be spread on land in an odorless state. Some obvious concerns of this system are: nitrates in the effluent disposed on the field; possible consequences of high rates of application to fields; nitrates, phosphates, and color of the effluent if stream discharge were to be used; and operating costs. (Solid Waste Information Retrieval System)

1430 - D4, E3

CHANGING FROM DUMPING TO RECYCLING. PART 2. ORGANIC WASTES

Sanitary Engineering Research Laboratory
University of California
Berkeley
C. G. Golueke
Compost Science, Vol. 13, No. 2, p. 20-23, March-April, 1972.

Descriptors: *Recycling, *Organic wastes, *Waste treatment, Feeds, Chemicals, Ponding, Anaerobic digestion, Activated sludge, Trickling filters, Stabilization, Oxidation lagoons
Identifiers: Pyrolysis, Fermentation, Soil, Manure

Methods of recycling the major groups of organic wastes (such as food processing or cannery, packing plant or slaughterhouse, manure, and wood wastes) are discussed. Their recycling creates three major products: soil, foodstuffs, and useful chemicals. The present treatment methods, concentrating on elimination of wastes rather than reclamation, are reviewed. Ponding is accomplished using anaerobic ponds, facultative ponds, oxidation ditches, and high-rate ponds. The treatment mechanism in the trickling filter is aerobic-biological stabilization of organic wastes suspended or dissolved in water. The activated sludge works on the same principle; it differs from the trickling filter process because no surfaces are provided for the attachment of a microbial layer; it is a compact process, subject to fairly close control. The anaerobic digestion process differs from the preceding processes (except the anaerobic pond), as biological decomposition takes place in the absence of oxygen. (Solid Waste Information Retrieval System)

1431 - D4, E3

ANOTHER RECYCLING VENTURE

Calf News, Vol. 11, No. 4, p. 15-16, April, 1973. 2 fig.

Descriptors: *Recycling, *Fermentation, *Anaerobic conditions, *Farm wastes, Amino acids, Feeds, Fuels, Cattle, Feed lots, Gases, Methane, Carbon dioxide, Costs, Waste treatment, Waste disposal
Identifiers: Thermophilic

Hamilton Standard initiated an experiment in December of 1970 to determine the feasibility of converting animal wastes into usable by-products by anaerobic fermentation. At the time of this report, two twenty-liter fermenters had been used for 1½ years. The operating temperature was in the thermophilic range and the feed material was animal waste obtained from cattle fed a high concentrate ration. Tank volumes of only 1/3 that of municipal systems were deemed practical. The system utilized very thick waste concentrations, operated with high process loading rates and small fermenter volumes, had low power requirements and generated its own fuel. Advantages of the process were: (1) It produced two products (fuel and animal ingredients) which could be used in the feedlot operation. (2) It would accept all of the solid wastes in the form available. (3) It had no discharges of liquid, solid, or gaseous pollutants. This study showed the anaerobic process to require two-thirds the capital investment and one-half the annual operating expense compared to the aerobic process. (Lee-East Central)

1432 - D4, E3

COMPOSTED MANURE CALLED 'AVAILABLE FUEL SOURCE,'

Feedlot Management, Vol. 16, No. 4, p. 28, 30, April 1974. 1 fig.

Descriptors: *Farm wastes, *Fuels, *Recycling, *Waste treatment, *Waste disposal, Aerobic bacteria, Thermophilic bacteria, Sulfur, Organic wastes, Pathogenic bacteria, Moisture content, Odor, Energy,
Identifiers: *Compost, *Manure, Pyrolysis

A method of converting the nation's animal wastes into usable sulfur-free fuels through a rapid composting process has been proposed as a way to ease the energy crisis. Three billion tons of organic wastes are produced each year. If all these were available, they could be converted to ¼ of our natural gas requirements. Manure doesn't lend itself to easy burning unless it is composted because of high moisture content. The action of thermophilic, aerobic bacteria produces heats high enough to drive off the moisture and kill pathogenic bacteria. The resulting product is safe, stable and easy to store. 15 to 28 BTU's are created for each BTU expended and the composted fuel can be added to other fuels to create higher energy levels. (Lee-East Central)

1433 - B1, E1

PERPETUAL-MOTION RECYCLING, OR, PIG MANURE INTO FISH FOOD

M. Franz
Compost Science, Vol. 12, No. 5, p. 21, September-October 1971. 1 fig.

Descriptors: *Recycling, *Farm wastes, *Livestock, *Hogs, *Feeds, *Fish farming, *Fish diets
*Fish food

A system has been proposed for recycling the 1,000,000,000 tons of animal manures generated in the United States each year. The manures are dumped into ponds where they stimulate the rapid growth of the plant life on which some fish feed. The fish can then be harvested for human consumption. Also, an aquatic plant species, Ipomoca repens, which is a suitable pig feed, can grow rapidly in the manure-fertilized ponds. A pig farm in Malaya flushes the manure from 700 pigs into eight fish ponds, covering 2¼ acres, and stocked with Siberain white Amur and Tilapia mossambica. About 9,000 lb of fish were produced in the first year, and up to 1,250 lb of Ipomoca repens can be harvested daily in peak seasons. The white Amur, buffalo fishes, and Tilapia have all been successfully farmed using this system, and all are considered highly desirable for humans. Several species of shellfish, large fresh-water shrimp, and silver and spotted Amur are also being considered as potentially adaptable to the system, both animal waste and idle-land problems can be economically solved. (Solid Waste Information Retrieval System)

1434 - B1, D2, D4, E2, E3

ENERGY NEEDED TO MANAGE ANIMAL WASTE

Electrical World, Vol. 178, No. 5, p. 70-72, September 1, 1972. 2 fig.

Descriptors: *Energy, *Farm wastes, *Management, *Recycling, *Waste treatment, *Waste disposal, Feed lots, Feeds, Drying, Spreading, Irrigation, Lagoons, Aeration.
Identifiers: *Animal waste, Pyrolysis

As the demand for some form of animal waste handling grows, so will the demand for energy necessary to drive these systems. The most popular way of dealing with animal waste today is to incorporate air into liquid wastes. Processes of this type use aeration wheels, discs, or aeration pumps and are generally electrically powered. Floating aerators, sprinkling systems, and oxidation ditches require substantial amounts of energy since they typically use 3-hp motors for each aeration unit. Animal wastes can also be dried and sold; the market at present for dried manure is very good. This process too requires heat energy from some source, as does pyrolysis, a means by which manure has been successfully converted into a range of products including crude oil, natural gas, and treated manure. Recycling of animal wastes as feed for the beasts that produced the manure in the first place probably holds more potential than almost any other recent feeding discovery. The basic requirement for the conversion of manure to feed is heat to promote the thermophilic bacterial reaction involved. Another popular concept—returning the wastes to land—will necessitate either electrical or internal-combustion power supplies to operate the sprinkler systems and pumps. (Solid Waste Information Retrieval)

1435 - A2, B1, E2

AVAILABLE NITROGEN IN RURAL ECOSYSTEMS: SOURCES AND FATE

Wisconsin University
D. R. Keeney, and L. M. Walsh
Hortscience, Vol. 7, No. 3, p. 219-223, June 1972. 4 fig. 4 tab, 37 ref.

Descriptors: *Nitrogen, *Ecosystems, *Sources, *Water pollution, *Groundwater pollution, *Farm wastes, Agriculture, Fertilizers, Leaching, Crops

This paper is concerned with the sources of nitrate and other nitrogen compounds in surface and groundwater. The most critical problem associated with nitrogen compounds is the possible adverse effect on animals and humans. Potential sources include precipitation, decomposition of crop residues and soil organic matter, legumes, manure, and nitrogen fertilizer. The nitrogen cycle is explained, and a schematic diagram of the cycle is given. Non-agricultural sources of nitrogen include commercial wastes, domestic wastes, urban runoff, industrial wastes, runoff from non-agricultural land, wetlands, geologic sources, lake and river sediments, and nitrogen fixation in waters. Movement of ground water accounts for 2 to 3 times more nitrogen than surface runoff. The amount of leaching at a particular location is largely related to conditions affecting evapotranspiration, soil physical conditions, and to precipitation distribution and intensity. Efficient crop production requires continued and perhaps even increased use of nitrogen fertilizer, but fertilizer and manure must be added in such a way to keep environment pollution to a minimum. Practices recommended for reduction of runoff losses include: use of crop residues; slopes, and fertilization to stimulate early growth of crops. Control of the rate of pollution of underground water can be exercised by methods explained. (Solid Waste Information Retrieval System)

1436 - B2, D2, D4

ELECTRICAL METHODS OF TREATING FARM EFFLUENT SHOULD CUT COSTS

Electrical Review, Vol. 187, p. 91, July 17, 1970, 1 fig.

Descriptors: *Waste treatment, *Effluent, *Costs, *Farm wastes, Livestock, Equipment, Aeration, Oxidation lagoons, Stabilization
Identifiers: *Electrical methods, Electrolytic flotation.

Three electrical methods of low-cost effluent treatment were shown by the Electricity Council at last week's Royal Agricultural Show at Stoneleigh (Warwicks). The first method demonstrated showed how effluent from a herd of 90 to 100 cows, amounting to 150 to 200 gal/day, could be dealt with by spray aeration in a two-section stabilization pond, with one section deeper than the other. Settled liquor is drawn from this deep section by a centrifugal pump and sprayed over the shallow section to aerate it. The overflow passes back over a weir into the deeper section. Total installation cost is estimated at $100 to $200. The second method is for treating pig effluent in an oxidation ditch. This process requires less land for disposal of the residue than would be required for untreated effluent and avoids smell. Manure fed into the ditch is continually aerated by an electric surface rotor consisting of an inverted cone with specially shaped paddles fixed to its underside. The third method is suitable for the removal of finely divided solids and has been tried at Capenhurst on paint as well as pig effluent. Charged hydrogen and oxygen gas bubbles rising from two closely spaced electrodes near the bottom of the treatment tank attract suspended particles and carry them to the surface. The floating sludge layer formed can be removed mechanically. (Solid Wastes Information Rerieval System)

1437 - B2, D4, E3

NUTRITIVE VALUE OF AEROBICALLY OR ANAEROBICALLY PROCESSED SWINE WASTE

Illinois University
Urbana
B. G. Harmon, D. L. Day, D. H. Baker, and A. H. Jensen.
Journal of Animal Science, Vol. 37, No. 2, p. 510-513, August, 1973. 5 tab, 17 ref.

Descriptors: *Nutrients, *Oxidation lagoons, *Farm wastes, *Hogs, *Feeds, *Recycling, Proteins, Aerobic treatment, Digestion, Anaerobic conditions, Performance, Diets
Identifiers: Rats, Residue, Oxidation ditch mixed liquor

The studies presented in this investigation were conducted to define nutritive value of waste processed by aerobic and anaerobic methods. An oxidation ditch was used which provided a means of collecting swine waste and an environment for biologically enhancing the waste to single-cell protein. Attempts to concentrate solids by allowing a fraction of the ditch contents to circulate through a settling-skimming tank yielded a product low in protein. The oxidation ditch mixed liquor serving as a nutrient solution combined with dry feed significantly improved weight gain and feed efficiency of finishing swine fed a dry diet that was marginal in protein. The nutrient solution containing 3 percent dry matter increased protein intake 2.5 percent, and lysine intake by 0.1 percent. It was found that addition of nutrient solution to corn alone did not significantly increase gain or efficiency. (Solid Waste Information Retrieval System)

1438 - A9, B3

MANURE STACK FLY BREEDING DEPENDS ON THE AMOUNT OF MANURE ADDED DAILY

W. L. Gajmerac
Hoard's Dairyman, Vol. 117, No. 12 p. 747, June 25, 1972. 1 fig.

Descriptors: *Breeding, *Farm wastes, *Waste disposal, *Waste storage, *Dairy industry, Agricultural runoff
Identifiers: *Manure stack, *Flies.

Recent work on a 40 head Wisconsin dairy farm showed that the daily summer addition of all manure from a dairy herd will cause an increase in housefly population. To help control fly population, it is suggested that the dairymen stack all the manure during the winter and spring, hold the stacked manure until fall, then spread it and plow it under immediately. This lets the dairymen haul the manure in the fall when they have more free time and it cuts down on polluted runoff into waterways It is believed that beneficial insects and mites inhabit the old stacks and eat the fly eggs and maggots. If only small amounts of manure are added daily during the fly breeding season these beneficial insects manage to keep fly population low. However, if large amounts of fresh manure are added daily, these insects cannot keep up with the fly reproduction. It is suggested that local health officials be contacted concerning their opinion toward flies before new manure handling facilities are developed. (Lee-East Central)

1439 - B2, D4, E2

EVERYTHING IS ON SLATS

L. Elam
Hoard's Dairyman, Vol. 117, No. 12, p. 746, June 25, 1972. 3 fig.

Descriptors: *Farm wastes, *Dairy industry, *Feed lots, *Waste disposal, Irrigation
Identifiers: *Slats, *Slatted floors

Charles Ochsner, of Sumner, Washington, has utilized an easy and inexpensive system of manure handling on his dairy through the use of slatted floors. This system cut one man off the payroll and virtually eliminated flies. The milking parlor, calf barn, feeding barn and free stall barn are arranged in a square with a 95,000-gallon concrete liquid manure tank in the center of the open square area, framed by the buildings. The free stall barn and feeding barn have slatted floors directly over pits in which sufficient water is kept to make the manure into solution. Each pit has sliding gates which when lifted allow the material to flow to the main pit by gravity. The gates are then closed and necessary water is put into the pit. The corral area over the main pit is all concrete floored. There is also a large concrete watering trough, and an agitator and pumping system over the center of the pit. Gratings which can be lifted out for inspection are located over drainways leading to the main pit so manure can be scraped in. It takes about a half hour daily to clean the corral with a shovel. The corral and slats are never washed down. Water and manure from the holding corral and milking barn flow into the pit through pipes. The liquid manure in the large pit is pumped through 4 inch lines to 115 acres of pasture and is spread by a large sprinkler. The pump, which is also used for agitation, is powered by a 70 horsepower diesel engine. (Lee-East Central)

1440 - A5, B1, D4, E2

FEEDLOT ODOR

Regional Extension Specialist
Feedlot Waste Management
M. D. Paine
Great Plains Beef Cattle Feeding Handbook, Cooperative Extension Service — Great Plains States, GPE-7800, L-1101, November, 1972, p. 7800.1—7800.2.

Descriptors: Feed lots, *Odor, *Aerobic conditions, *Anaerobic conditions, *Waste treatment, *Ammonia, Biological oxygen demand, Nutrients, Metabolism, Nitrogen, Aeration, Waste disposal.

Feedlot odor is caused by the anaerobic metabolism of nutrients found in cattle manure. However, when the nutrients are metabolized aerobically the end products are heat, CO2, and water. For aerobic metabolism to occur, the oxygen transfer rate must exceed the biological oxygen demand. When the demand is greater than the transfer rate, anaerobic metabolism produces odor compounds. Ammonia is also produced in feedlots. It is lighter than air and has an irritating smell. It escapes as a gas from urine, but will be absorbed by moist manure. The transfer of nitrogen in ammonia and amines not only produces irritating smells, but may enrich ponds, hastening eutrophication. Odor occurs in three places—the dry surface, solid manure beneath the surface, and holding ponds. Aerobic metabolism depends on temperature, oxygen, and water; the last two may possibly be controlled. Moisture can be partially controlled by good drainage, cattle density and water. Since a 40% moisture content is required for best aerobic activity, sprinkling may be required in dry seasons. Odor from ponds may be controlled by diluting nutrients, adding more water, or using aeration equipment. Manure may be stockpiled into compost heaps prior to being dispersed on farm land. (Lee-East Central)

1441 - B1

SOLID STATE CONTROLS FOR ENVIRONMENTAL CHAMBERS

Department of Agricultural Engineering
Arkansas University
Fayetteville
T. R. Rokeby, G. S. Nelson, and G. C. Harris, Jr.
Presented at 1972 Annual Meeting, American Society of Agricultural Engineers, Hot Springs, Arkansas, June 27-30, 1972, Paper No. 72-418, 11 p. 9 fig.

Descriptors: *Poultry, *Performance, *Environmental control, Temperature, Air circulation, Growth rates
Identifiers: *Solid state controls, *Environmental chambers, Drinking water, Feed conversion

Research was done to regulate temperature, air flow and drinking water temperature in order to examine the effects on poultry performance. Chamber design criteria included the following. Dry bulb temperature ranged from 35°F to 105°F. Wet bulb temperature ranged from 35°F to 95°F. Air movement didn't exceed 300 fpm at the floor level. Air exchange was fixed at 300 cfm. Chamber size was 8' by 12' by 7'. Chamber ambient conditions were 80°F maximum dry-bulb, Temperatures ranged from 69°F maximum wetbulb summer to 70°F dry bulb in the winter. Drinking water temperature was controlled. Different initial brooding temperatures, different rates of temperature decline with age, and different water temperatures were investigated. Analysis of results was incomplete but indicated that growth and feed conversion were best with initial brooding temperatures of 89°F (32°C), and that cooling the drinking water could aid the chicken to adapt to higher ambient temperatures. (Lee-East Central)

1442 - B1

OPERATIONAL CHARACTERISTICS OF MEAT ANIMALS

Department of Agricultural Engineering
Nebraska University
Lincoln
N. C. Teter, J. A. DeShazer, and T. L. Thompson

Descriptors: *Metabolism, *Performance, *Mathematical models, Temperature, Feeds, Mud, Energy loss, Environment
Identifiers: *Operational characteristics, *Beef, Energy intake

Basic data published on the energetics of beef animals combined with the basic theory of metabolic changes in beef animals were used to develop a model to predict characteristics and production of growing beef as a function of effective temperature, feed, and mud conditions. In cold weather much of the animal's energy is used to maintain body heat so more feed is required per pound of gain. The heat value of the feed, calculated in BTU's, determines how much feed will be needed for each pound of gain. Mud conditions are important, for an animal must expend high amounts of energy to move in mud that could otherwise be converted into meat. (Lee-East Central)

1443 - A2, A9, E2

SURFACE WATER QUALITY IS INFLUENCED BY AGRICULTURAL PRACTICES

Minnesota University
Morris
R. F. Holt
Transactions of the American Society of Agricultural Engineers, Vol. 16, No. 3, p. 565-568, 1973, 3 tab, 34 ref.

Descriptors: *Surface waters, *Water quality, *Water pollution, Fertilizers, Farm wastes, Pesticides, Agricultural runoff, Phosphorus, Nitrogen, Soil conservation, Waste disposal.
Identifiers: *Agricultural practices, Leptospirosis, Fish kills

The effects of fertilizer runoffs, pesticides, and feed lot wastes on surface water quality are discussed in this paper. The three constituents of animal waste that pose a threat to water quality are BOD, infectious agents, and dissolved chemicals, which are primarily nutrients. Rapid influxes of animal waste into waterways can cause massive fish kills, due to reduced oxygen levels; constant, but less rapid, contamination will simply drive the fish away, killing only less mobile forms. Maximum textured, well drained soil can degrade 250 to 300 lb of BOD per acre per day. The soil also quickly destroys pathogens, such as streptococcus, anthrax, hog cholera, and mastitis. Although few of these diseases infect man, all can be transmitted to other animals. Plant nutrients, most frequently nitrogen and phosphorus, allowed to run off into streams, either directly from the feed lot or indirectly after application to frozen or saturated soils, are also detrimental to water quality. If manure is disced in as soon as applied, runoff of nutrients is avoided. (Solid Waste Information Retrieval System)

1444 - A4, B3, E2

EFFECT OF FEEDLOT MANURE ON SOIL AND WATER QUALITY

Research Station
Lethbridge, Alberta T1J 4B1
Canada Department of Agriculture
T. G. Sommerfeldt, U. J. Pittman, and R. A. Milne
Journal of Environmental Quality, Vol. 2, No. 4, p. 423-427, October-December, 1973. 3 fig, 4 tab, 19 ref.

Descriptors: *Feed lots, *Farm wastes, *Soil contamination, *Water pollution, *Groundwater pollution, Nitrogen, Phosphorus, Effluent, Fertilizers, Waste disposal, Cattle
Identifiers: *Soluble salts, *Manure

A study of soil pollution and ground water pollution caused by feedlot manure was undertaken in southern Alberta. The study also investigated long term effects of manure applications on the nitrogen, phosphorus, and soluble salt content of cultivated soil under irrigation. It was found that nitrate and phosphorus content of surface soil was higher in soil adjacent to feedlots than in soil away from them. However, at depths greater than 150 cm, the differences were insignificant. This was also found to be true in ground water at depths of 1-5 meters. No evidence was found which indicated that nearby streams or lakes were polluted by feedlot effluent. Long term effect studies indicated that 40 annual applications of manure did not elevate nitrogen, phosphorus or soluble salt contents of the soil significantly. The unique combination of soil, climate, and management in southern Alberta has been an important factor in limiting soil and water pollution from manure. (Russell-East Central)

1445 - B2, D1

DESIGNING GUTTER FLUSHING SYSTEMS FOR SWINE

Agricultural Engineering Department
Missouri University
Columbia
R. M. George, and C. E. Browning
Presented at the 1973 Winter Meeting, American Society of Agricultural Engineers, Chicago, Illinois, December 11-14, 1973, 11 p. 2 fig. 5 tab, 3 ref.

Descriptors: *Design, *Hogs, *Farm wastes, *Waste treatment, *Waste disposal, *Lagoons, Effluent, Flow, Width, Depth
Identifiers: *Gutter flushing systems, *Swine, Slope

Design procedures are given for designing open gutter and under slat gutter systems for swine. Gutters should be one half as wide at the exit as they are at the origin and should be wide enough to induce hogs to utilize them. Amounts of water needed vary with depth of manure; width, depth, length, and roughness of the gutter; and the velocity of the water needed to flush the system, (Lee-East Central)

1446 - A2

A STUDY OF FACTORS INFLUENCING THE NITROGEN AND PHOSPHORUS CONTENTS OF NEBRASKA WATERS

Nebraska University
Lincoln
J. Muir, E. C. Seim, and R. A. Olson.
Journal of Environmental Quality, Vol. 2, No. 4, p. 466-470, October-December, 1973. 1 fig, 5 tab, 14 ref.

Descriptors: *Nitrogen, *Phosphorus, *Water pollution, *Groundwater pollution, *Nebraska, Irrigation, Agricultural runoff, Fertilizers, Nutrients, Sampling, Streamflow

Research was conducted to determine amounts and sources of nutrients and phosphorus in Nebraska waters. Results indicate that the quality of Nebraska waters is not being materially influenced by agricultural use of commercial fertilizers. Exceptions exist when fertilizer nitrogen contributes to ground water nitrates. This occurs when there is intensive irrigation of sandy soil and with irrigated crop production in valley positions of shallow underlying water tables. It was found that nutrient levels in the water are governed more by livestock and human densities than by any other factor. The high nitrogen content of streams during peak flow can be attributed partially to direct runoff into streams resulting from high rainfall intensity. (Russell-East Central)

1447 - A2

SEEPAGE OF FEEDYARD RUNOFF WATER IMPOUNDED IN PLAYAS

USDA Southwestern Great Plains Research Center
Bushland, Texas
O. R. Lehman, B. A. Stewart, and A. C. Mathers

Descriptors: *Agricultural runoff, *Seepage, *Playas, *Feed lots, *Impoundments, Farm wastes, Aquifer, Nitrates, Chlorides, Soil water, Sampling
Identifiers: Ammonium

Research was conducted in a playa at Randall County Feedyards Inc., 10 miles, S.W. of Amarillo, Texas, to determine if pollutants from feedyard runoff water seep through playa soil and contaminate groundwater. In August, 1968, a large amount of runoff was impounded in the playa. In March, 1969, soil samples were taken at various sites across the playa at depths from

1 to 13 feet. A second playa 3 miles North was used as a representative before impoundment of feedyard runoff. Soil samples were analyzed for nitrite, nitrate, ammonium, chloride, and water content. Concentrations of nitrite, nitrate, ammonium and chloride were found to decrease steadily with depth. The percentage of soil moisture also decreased with depth. Findings suggest that little or no pollutants will seep through the bottom of playas with fine soil texture. The hazard of groundwater pollution may be greatest in smaller deeper playas with sloping, coarse soils immediately surrounding the playa bottom. (Lee-East Central)

1448 - A9, B2, E2

THE INFLUENCE OF MANURE SLURRY IRRIGATION ON THE SURVIVAL OF FECAL ORGANISMS IN SCRANTON FINE SAND

Department of Microbiology
Florida University
Gainesville
F. Dazzo, P. Smith, and D. Hubbell
Journal of Environmental Quality, Vol. 2, No. 4, p. 470-473, October-December, 1973. 2 fig, 2 tab, 20 ref.

Descriptors: *Sprinkler irrigation, *Farm wastes, *Waste disposal, *Salmonella, *Soil contamination, Pathogenic bacteria, Enteric bacteria, Cattle
Identifiers: *Manure, *Slurries, *Survival, *Fecal organisms, *Scranton fine sand, Fecal coliforms, Health hazard

This study was undertaken to examine the effects of various rates of irrigation of cow manure slurry on the survival of Salmonella enteritides serotype Enteritidis and fecal coliforms within scranton fine sand. Millet was inoculated with O, 1.27, 2.54, and 5.08 cm of the cow manure slurry. The numbers of viable enteric organisms were determined at various times after inoculation. It was found the death rate of both groups declined in soil which previously had received manure application. Results indicate several long-term ecological effects of increasing the manure slurry irrigation rates on the receiving soil. The potential danger of health hazards associated with the use of contaminated soil would be expected to increase with increasing rates of application. This study on a pilot scale irrigation system showed that pathogen survival is a problem which should be considered and controlled in the design and operation of a waste treatment process involving sprinkler irrigation on land. (Russell-East Central)

1449 - A2

BENTHIC MACROINVERTEBRATE COMMUNITY STRUCTURE IN A GREAT PLAINS STREAM RECEIVING FEEDLOT RUNOFF

Kansas State Teachers College
Emporia
C. W. Prophet, and N. L. Edwards
Water Resources Bulletin, Vol. 9, No. 3, p. 583-589, June, 1973. 4 tab, 8 ref.

Descriptors: Benthic fauna, *Feed lots, *Agricultural runoff, Kansas
Identifiers: *Benthic macroinvertebrate community, *Environmental quality, *Species diversity, *Cottonwood River, Water pollution, Fish-kill, Sampling, Environmental stress

Due to the increase and concentration of feedlots, a study was undertaken to determine the effect of feedlot runoff on the ecological balance and environmental quality of the Cottonwood River in Kansas. The effect was evaluated by analysis of community structure of benthic macroinvertebrates using the species diversity' index (d). Sixty-five taxa were identified during the study from 1968 to 1971. The species diversity index was lower closer downstream from the feedlots and increased at each station down stream, but at all stations it was lower than at the control station. There was a significant increase in the index after the feedlots were closed. Results indicate that runoff from feedlots had an adverse effect on the environmental quality of the river, and this effect continued long after water quality was restored. However, the recovery was rapid once the environmental stress was removed. (Russell-East Central)

1450 - B3, E2

USING POULTRY LITTER, IRRIGATION, AND TALL FESCUE FOR NO-TILL CORN PRODUCTION

United States Department of Agriculture
Athens, Georgia
J. R. Carreker, J. E. Wilkinson, J. E. Box., Jr., R. N. Dawson, E. R. Beaty, et al.
Journal of Environmental Quality, Vol. 2, No. 4, p. 497-500, October-December, 1973. 10 fig, 6 tab, 14 ref.

Descriptors: *Poultry, *Litter, *Irrigation, *Fescues, Crops, Fertilizers, Nitrogen, Phosphorus, Potassium, Lime, Productivity, Farm wastes, Waste disposal, Erosion control, Irrigation, Agricultural runoff
Identifiers: *No-till corn, *Southern Piedmont, *Killed sod, Atrazine, Paraquat, Pollution

This study was undertaken because of the need for a cropping system in the Piedmont area which would increase the production of forage and grain, control erosion, and utilize the available nutrients in poultry litter. The objective was to determine the response of irrigated no-till corn, Zea Mays (L), to applications of poultry litter in tall fescue (Festuca arundinacea Schreb.). Corn was planted and irrigated in live soil and in soil that was killed with 2.2 and 0.28 kg/ha atrazine and paraquat, respectively. Poultry litter was then added to soil plots at different rates. Nitrogen, phosphorus, potassium, and lime were added uniformly to all soils. Corn yields were higher in killed sod than in live sod. The overall increase was 80%. This method gave excellent runoff and erosion control and produced needed grain while utilizing a waste product with minimum environmental hazards and with small amounts of litter application. (Russell-East Central)

1451 - A1, B1, D1, E1, F4

PROCEEDINGS: BIG ISLAND SWINE CONFERENCE, CURRENT AND FUTURE TRENDS IN SWINE WASTE MANAGEMENT

Proceedings: Big Island Swine Conference, Current and Future Trends in Swine Waste Management, Miscellaneous Publication 82, Cooperative Extension Service, University of Hawaii, September 11, 1971, 28 p.

Descriptors: *Hogs, *Farm wastes, *Hawaii, *Waste treatment, *Waste storage, *Waste disposal, Confinement pens, Production.
Identifiers: *Pork industry, *Pollution, *Swine, *Waste management, *Trends

This conference was held with the purpose of discussing pork producers' problems and solutions. Planning, budgeting, production, pollution, ecology, waste treatment, waste disposal, and zoning were major topics discussed at this meeting. It was hoped that the conference would be a major step forward in pushing standards for quality, price stabilization, and technological improvement in Hawaii. (Merryman-East Central)

1452 - B2, D4

FEDERAL PRODUCER ASSISTANCE PROGRAMS

A. Bennett
Proceedings: Big Island Swine Conference, Current and Future Trends in Swine Waste Management, Miscellaneous Publication 82, Cooperative Extension Service, University of Hawaii, September 11, 1971, p. 5.

Descriptors: *Farm wastes, *Waste treatment, *Cost sharing, Aerobic conditions, Anaerobic Diversion structures, Hawaii
Identifiers: *Federal Producer Assistance

To assist producers in installing adequate treatment facilities for animal wastes, the Agricultural Stabilization and Conservation Service provides payments in the form of cost-share for installation of waste disposal systems. These systems are usually one of three types: Lagoons, Storage facilities, or Diversions. Lagoons treat wastes in such a way that the waste can either be directly discharged to a waste course or on land. There are two types of lagoons—Aerobic, which requires a large land area, and anaerobic, which requires little land area but produces an offensive odor. Storage facilities are used temporarily until waste is removed and spread on land for fertilizer as needed. Diversions are used to divert excess runoff from feedlots or waste disposal areas to treatment locations. In Hawaii, lagoons should be adequate to fill the needs for waste treatment because they can function year round; whereas, on the mainland temperature variations allow them to function only eight to nine months of the year. (Russell-East Central)

1453 - B2, D4

BASIC REQUIREMENTS OF HOG PEN CONSTRUCTION AND LIQUID MANURE DISPOSAL

J. Nakahara
Proceedings: Big Island Swine Conference, Current and Future Trends in Swine Waste Management, Miscellaneous Publication 82, Cooperative Extension Service, University of Hawaii, September 11, 1971, p. 6-7.

Descriptors: *Confinement pens, *Construction, *Hogs, *Liquid wastes, *Waste storage, *Waste disposal, *Hawaii, Cesspools, Septic tanks, Lagoons
Identifiers: Manure

Many problems of waste disposal have originated from confinement hog feeding. The first consideration to alleviate these problems is construction of feeding facilities. Floors, feed troughs, and gutters should be constructed so that they are impervious to water and can be properly flushed with water. Loose boards should not be used unless they can be easily removed. Feed bins and pens should be constructed so that they are rodent-proof. Presently, there are four methods of liquid disposal commonly used. Cesspools and septic tanks can be utilized in small operations, but aren't feasible in large ones. Spreading of fertilizer can be used, but a large land area is required. Lagoons can also be constructed but should be in accordance with guidelines laid down by the Department of Health. Adequate manure disposal can be controlled by proper design and maintenance of lagoons. However, in Hawaii, lagoons are often undersized because of the scarcity of land. Regardless of the type of waste disposal used, it must include not only the prevention of health hazards, but also the prevention of aesthetic nuisances. (Russell-East Central)

1454 - B1, F2

HOG PRODUCTION ZONING REQUIREMENTS

P. Yoshimura
Proceedings: Big Island Swine Conference, Current and Future Trends in Swine Waste Management, Miscellaneous Publication 82, Cooperative Extension Service, University of Hawaii, September 11, 1971, p. 8-9.

Descriptors: *Hogs, *Zoning, *Hawaii
Identifiers: Piggery, Non-Conforming piggery, Residential agricultural zone, Unplanned zone, Agricultural zone, Planning Commission, Property line, Board of Health

By Hawaiian state law a piggery is any premise on which five or more weaned hogs are maintained. The maintenance of hogs is regulated by zoning requirements and pigs may be allowed in three zones: The RA zone, A zone, and U zone. The RA or Residential Agricultural zone applies to a low density suburban area with a minimum allowable lot of one-half acre. It is subject to the Department of Health and it must be kept at least sixty feet from any property line. The A or Agriculture zone applies to an agricultural area with allowable lot sized from 1-40 acres. It must be 1,000 feet or more from any major public road and accessory buildings shall be at least 100 feet from the front property line. The U or Unplanned zone applies to areas not subject to sufficient studies to adopt specific zones. Lot sizes are a minimum of five acres. Pens cannot be closer than 100 feet from any property line or 30 feet from any residence, and they must be on sites approved by the Board of Health. Variances from these regulations can be granted by the Planning Commission. Also piggeries in existence before zoning may remain as long as they do not enlarge. (Russell-East Central)

1455 - A5, A9, B1, F4

SWINE WASTE DISPOSAL AND CONTROL

Department of Animal Sciences
University of Hawaii
Honolulu
Hugh Williams
Proceedings: Big Island Swine Conference, Current and Future Trends in Swine Waste Management, Miscellaneous Publication 82, Cooperative Extension Service, University of Hawaii, September 11, 1971, p. 10-11. 4 ref.

Descriptors: *Hogs, *Waste disposal, *Control, *Confinement pens, *Farm wastes, Aerobic conditions, Anaerobic conditions, Recycling, Livestock, Pollutants, Hawaii
Identifiers: Composting, Land spreading

The Hawaii Department of Health Studied 179 hog operations and found that 94 posed a problem to neighbors due to animal wastes. It is estimated that fifty percent of wastes were from confinement areas, and this poses a particular problem in Hawaii because of scarcity of land. The study found that pollution from animal manures arises because of: organic substances, inorganic substances, odors, infectious agents, and insects. Waste management systems usually incorporate land spreading, biological treatment, composting, or recycling as feed. Land spreading is the major method employed, but it requires a large land area. Biological treatment by means of lagooning is more feasible in Hawaii, and there are two types— aero bic and anaerobic. Anaerobic lagoons produce odors but do not require as much land area as the non-odorous aerobic lagoons. Composting or drying is also effective in that it reduces volume and weight by fifty percent. Recycling as feed could become an effective means of waste utilization, but the Food and Drug Administration looks unfavorably on this method. However, experimental work has incorporated as much as fifty-seven percent manure into cattle rations. (Russell-East Central)

1456 - B2, D4, E1

SWINE HOUSING AND WASTE DISPOSAL DESIGNS

University of Hawaii
Honolulu
Donald Nelson
Proceedings: Big Island Swine Conference, Current and Future Trends in Swine Waste Management, Miscellaneous Publication 82, Cooperative Extension Service, University of Hawaii, September 11, 1971, p. 13-23. 5 fig. 7 tab.

Descriptors: *Hogs, *Farm wastes, *Waste disposal, *Design, *Lagoons, *Oxidation lagoons, Aerobic conditions, Anaerobic conditions, Biological treatment, Liquid wastes, Surface runoff, Hawaii
Identifiers: *Swine, Slatted floors

The system chosen for proper waste disposal is very important. It should be adequately designed to handle current and future wastes, and it should comply with all laws. To develop a lagoon system, the floors should be slotted so they can be flushed with water. There should be a gutter beneath the floors which could either store the wastes or carry them to a lagoon or oxidation ditch. The lagoon is either a deep ditch called an anaerobic lagoon or a shallow one called an aerobic lagoon. The liquid of both should be maintained and excess should be spread on land. In oxidation ditches, decomposition is accomplished by aerobic bacteria. These bacteria decompose with virtually no odor. Oxidation ditches can also be used in conjunction with other disposal methods such as lagoons. A problem with lagoons and oxidation ditches is runoff of rainfall. This, however, can usually be controlled by choice of locations. (Russell-East Central)

1457 - B1, F3

HAWAII, ISLAND OF HOPE FOR PORK INDUSTRY

State Department of Agriculture
Hawaii
F. Erskine
Proceedings: Big Island Swine Conference, Current and Future Trends in Swine Waste Management, Miscellaneous Publication 82, Cooperative Extension Service, University of Hawaii, September 11, 1971, p. 25-27.

Descriptors: *Hawaii, Hogs, Automation
Identifiers: *Pork industry, Swill collection, Super farm, Agri-business, Tilapia production

The high cost of land in Hawaii has caused the high cost of pork production. This high cost of land paints a dark picture for the pork industry because it doesn't allow the Hawaiian pork producers to compete with the mainland. The ideal way to compete with other pork producers is to have a super farm which is a massive agricultural complex for production of beef, pork, feed, etc., and to have a large combined waste disposal system to eliminate pollution. This super farm could someday be a reality; but, for the present, pork producers must organize to improve the pork industry by: finding capital, planning and developing for the industry's future, establishing more efficient programs such as swill collection and processing, establishing standards of quality and price stabilization, developing and supporting marketing programs, pushing technological research, and improving the aesthetics of the hog farm through landscaping and odor reduction. (Russell-East Central)

1458 - B1, F3

CURRENT PROBLEM FACING THE PORK PRODUCERS — SOME OBSERVATIONS

S. Roehrig
Proceedings: Big Island Swine Conference, Current and Future Trends in Swine Waste Management, Miscellaneous Publication, 82, Cooperative Extension Service, University of Hawaii, September 11, 1971, p. 28.

Descriptors: Hogs, *Production, Processing, Hawaii
Identifiers: *Pork industry, *Slaughtering

It appears that Big Island pork producers face a promising future. The chief way to insure this future is to work together and have periodic meetings to consider problems of the industry—problems such as disease, production, ecology, etc. It is also important that price standards and uniform consumption policy be adopted. Local pork producers should collectively promote consumption of pork in the Islands. Yet, the producers must face the problem of slaughtering. Since there is only one slaughter house on Oahu, the producers themselves should construct and maintain a slaughter house. By doing this, they coulld have some control over the disposition of the carcasses. With a joint effort of the government and the pork producers, the Hawaiian pork industry should prosper in the future. (Russell-East Central)

1459 - B1, E1

SUMMARY AND CONCLUSION

County Extension Service
Hawaii
T. T. Yamamoto
Proceedings: Big Island Swine Conference, Current and Future Trends in Swine Waste Management, Miscellaneous Publication 82, Cooperative Extension Service, University of Hawaii, September 11, 1971, p. 29.

Descriptors: *Hogs, Confinement pens, Pollutants, Ecology, Hawaii
Identifiers: *Pork production, *Waste management

The theme of the Conference was: "Current and Future Trends in Swine Waste Management." It was "A step in the right direction" as far as the efficiency of the pork industry of Hawaii is concerned. Pork producers must become more aware than ever of pollution, ecology, and environment if the industry is to grow and fulfill the state pork needs. There are now sixty sows on three-fourths acres of land as compared with twenty sows on four acres of pasture land in the past before confinement was adopted. This kind of change brings many problems which must be faced. In closing, early planning of a waste disposal system is vital for future expansion and productivity. (Russell-East Central)

1460 - A1, B1, F2

AN IN-DEPTH LOOK AT FEDERAL POLLUTION CONTROLS

Wisconsin University
Madison
R. E. Graves
Hoard's Dairyman, Vol. 119, No. 9, p. 614, 653. 1 fig.

Descriptors: *Regulation, *Environmental control, *Feed lots, *Livestock, *Poultry, Agricultural runoff, Permits, Waste treatment, Waste disposal, Federal Water Pollution Control Act
Identifiers: *Federal pollution controls, *Zero discharge, Environmental Protection Agency

New EPA guidelines for feedlots were published in February and were met with tremendous reaction. One reason for the strong reaction was that they seemed to include livestock under every conceivable system of management. No distinction was made based on numbers of animals, concentration of animals, or location with respect to streams or lakes. EPA considers any confined group of beef, dairy cattle, swine, sheep, horses, chickens, turkeys, or ducks a potential feedlot. The most drastic change found in the guidelines and standards recently issued was the exclusion of smaller livestock farms. Exclusion from these regulations does not mean that smaller livestock farms can forget about pollution control. Any person or firm is still responsible for water pollution resulting from its actions or inactions. The most outstanding conclusion and recommendation of this report deals with "zero discharge." Without establishing a meaningful definition of zero discharge or even feedlot pollution, it was concluded that practicable available technology is available to achieve zero discharge from all feedlots by July 1, 1977. (Cartmell-East Central)

1461 - A1, B1, F2

QUALITATIVE CHANGES IN THE FISH-FAUNA OF THE UPPER NEOSHO RIVER SYSTEM, 1952-1967

F. B. Cross, and M. Braasch
Transactions of the Kansas Academy of Science, Vol.71, No. 3, p. 350-360, January 7, 1969. 1 fig, 1 tab, 6 ref.

Descriptors: *Fish, *Water pollution, *Feed lots, *Farm wastes, Kansas
Identifiers: *Upper Neosho River, Fish fauna, *Fish kills

A comparison obtained from extensive collections from the Upper Neosho River System in Kansas was made between species of fish collected in 1952 and 1967. The study indicated rapid deterioration of the fish fauna. Numerous fish kills were noted to occur in 1966 and 1967 and were attributed to pollution from feedlots whose wastes drained into nearby streams. Five species of fish collected in 1952 were not found in 1967. Other species are in danger of disappearing while some 20 species have declined in abundance during the 15-year period. Fish which predominated in 1967 were kinds whose surface-dwelling habits enhance their tolerance of waste pollution. It is hoped that laws passed in 1967 will be strictly enforced. If pollution is curbed, perhaps the number of fish kills will be reduced. (Russell-East Central)

1462 - B1, E3

COPROLOGY: A POLLUTION SOLUTION?

Ohio State University
Columbus
E. P. Taiganides
Agricultural Engineering, Vol. 55, No, 4, p. 21, April, 1974. 1 fig.

Descriptors: *Recycling, *Farm wastes, Sewage, Municipal wastes, Pollutants, Foods, Ecology, Methane, Gases
Identifiers: *Coprology, *Pollution, *Waste management, Building blocks

Coprology is defined as the science of waste management. The basic premise of coprology is that there is no such thing as waste. Everything is a resource. Research is being conducted to find new ways of recycling wastes. It is estimated that livestock wastes in the United States could be used to produce methane gas in sufficient quantities annually to meet a large part of our national gas requirements. The potential value: of manure-derived methane gas is over one billion dollars. Also, city waste refuse is being made into building blocks or into heat energy. City sewage is being used to increase productivity of land. In the future, the need for more food will drastically increase. With this increase will be a matched increase in waste production. The problems of waste management must be dealt with and controlled and future industrialization must not only be justified on economic and political terms, but also on ecological terms. (Russell-East Central)

1463 - B1, D2, D4, E2

MECHANICAL AERATION OF A WASTE DISPOSAL MANURE PIT

Area Agricultural Engineering Specialist, Higginsville, Missouri
L. V. Ellis, and R. M. George
Presented at 1973 Winter Meeting, American Society of Agricultural Engineers, Chicago, Illinois, December 11-14, 1973, 6 p. 2 fig, 4 ref,

Descriptors: *Aeration, *Waste treatment, *Waste disposal, Mechanical equipment, Liquid wastes, Odor, Costs, Waste storage
Identifiers: *Milking machine compressor

A swine producer in Johnson County, Missouri uses a milking machine compressor unit to bubble air through liquid manure holding pits. Complete design for the system is given in detail. The final results of this experiment are not all known at this time, but the producer wants to continue with this system of aerating his manure pits. He feels the offensive odors have been greatly reduced in the pits, his building, and from the effluent when it is spread on his fields. The solids in the pits are broken up and held in suspension. The manure that was spread on the fields gave good response in the form of plant growth. Operating costs are small; electricity costs about 3c an hour. If the unit operates for 16 hours in 24 hours, the cost is about 48c per day. (Cartmell-East Central)

1464 - C2

FRACTIONATION OF A CHICK GROWTH DEPRESSING FACTOR FROM RYE

Department of Animal Science
Washington State University
Pullman
R. Fernandez, E. Lucas, and J. McGinnis
Poultry Science, Vol. 52, No. 6, p. 2252-2253, November 1973. 5 tab, 16 ref.

Descriptors: *Poultry, *Diets, *Growth rates, *Farm wastes, Ethers, Swine, Feeds, Performance, Water
Identifiers: Fractionation, *Growth depressing factor, *Rye, Acetone, Extract

Four experiments were conducted to study the nature of chick growth depressing factor or factors present in rye. Chicks were fed acetone extracted rye. Day-old chicks were used in all experiments. Results obtained in Experiment 1 showed clearly that the acetone extraction of rye did not remove the chick growth depressing factor present in rye. The results of Experiments 2, 3, and 4 consistently indicated that the fraction of rye that contains most of its chick growth depressing properties and also contains the factor causing sticky droppings associated with feeding rye to young birds can be removed by a simple water extraction. Experiment 2 gave a clear indication that feces stickiness by itself was not deleterious to chick growth and that this effect was caused by a factor that was different from the one that causes growth depression. (Cartmell-East Central)

1465 - F4

NATIONAL ANIMAL FEEDLOT WASTES RESEARCH PROGRAM

Environmental Protection Agency
Robert S. Kerr Environmental Research Laboratory
Ada, Oklahoma
L. R. Shuyler
Environmental Protection Agency Report, EPA-R2-73-157, February 1973.

Descriptors: *Feedlots, *Animals, *Wastes, Water quality control, Pollution abatement, Planning
Identifiers: *National research program, *Animal feedlot wastes, Agricultural waste water

The status of the National Animal Feedlot Wastes Research Program is presented. Current research projects and future program development are discussed. Research and investigations are needed to evaluate the effectiveness of potential treatment and control measures. Examples of such projects are presented. Demonstrations and educational activities will be required to provide widespread acceptance of new concepts. The future plans of the program are presented on a PERT diagram. The time frame for the PERT diagram is dependent on funding and may be adjusted slightly in the future.

1466 - A1, E3

AGRICULTURAL WASTES AND THE ENVIRONMENT

Agricultural Engineering Department
Ohio State University
Columbus
E. P. Taiganides
Agricultural Engineering, Vol. 51, No. 6, p. 358-359, June, 1970.

Descriptors: *Farm wastes, Water pollution sources, Effects, Irrigation effects, Insecticides, Nitrates

Agricultural wastes contribute fifty percent of the sediment load in rivers in the United States. Animal wastes, crop residues, in addition to insecticides, fertilizers, waste waters from agrochemical processing plants make up these polluting agricultural wastes. The author contends that 'recycling these wastes into the production system' is the only effective way to manage these wastes. (Holmes-Rutgers)

1467 - A8, D3

CONTROL OF LARVAE OF THE HOUSEFLY AND THE HORN FLY IN MANURE OF INSECTICIDE-FED CATTLE

Entomology Research Division
Agricultural Research Service
USDA, Kerrville, Texas
R. O. Drummond, T. M. Whetstone, and S. E. Ernst
Journal of Economic Entomology, Vol. 60, No. 5, p. 1306-1308, October, 1967. 2 tab, 13 ref,

Descriptors: *Farm wastes, *Insecticides, *Cattle, *Control, *Larvae, Sampling
Identifiers: *Flies

Short term feeding experiments were conducted to see if certain insecticides fed to cattle could be effective in controlling the common house fly Musica Domestica L. and the horn fly Hematobia irritans L. Fly larva was implanted in the manure of insecticide-fed cattle, and the number of adults that emerged were calculated in determining the effects of the treatments. Mg per kg per day of insecticide effective against house fly larvae were: 5.0 of Bay 37342, 10.0 of bromophos and SD-8447. Mg per kg per day of insecticide effective against horn fly larvae were: 0.5 of Bay 37341, 1.0 of Bay 37340, 10.0 of bromophos, 2.5 5.0 of famphur, 0.5-1.0 of fenthion, 1.5 of Imidan, 10.0 of Shell SD-8447, and 2.5 of Stauffer R-3828, Perhaps in the future insecticides can be combined with a polymer to prevent them from being absorbed in the gastro-intestinal tract and feed incorporation of insecticides can become a common method of fly control. (Russell-East Central)

1468 - D2, E3

DEHYDRATION OF ANIMAL WASTES FROM LIVESTOCK MARKETS

Columbia ARS Research Station
North Central Region
H. F. Mayes, and T. F. Webb
Agricultural Research Service Report, ARS-NC-9, 6 p., December, 1973, 3 fig, 1 tab, 4 ref.

Descriptors: *Dehydration, *Farm wastes, *Waste treatment, *Recycling, Livestock, Odor, *Dusts, Waste disposal, Moisture content, Drying, Fertilizers, Costs
Identifiers: *Animal wastes

Dehydration is a usable method of disposing of large quantities of cattle manure and bedding on livestock markets. The four plants covered in this study used converted alfalfa dehydrators as rotary dryers. All of the rotary drums contained internal flighting, which was an integral part of the outer wall of the drum. Materials processed through dehydrators consisted of cattle manure and bedding. The heat for drying was supplied by natural gas which was burned either in one large nozzle or from several small nozzles. All of the dehydrators studied had a relatively large electrical power demand. Material taken from the conveyor ranged from 37.7 to 64.5 percent. Extremely important is the moisture content of the dried material leaving the rotary drum, and it is difficult to control. Operating problems are discussed in detail. The operating cost of a dehydrating plant consist of labor, fuel, electricity, repairs, and miscellaneous costs. The total operating cost for producing a pound of dried product ranged from 1.6 to 2.2 cents. Dehydrating plants sell the dried product as a specialty fertilizer. (Cartmell-East Central)

1469 - A1

COLIFORM BACTERIA IN CHICKEN BROILER HOUSE DUST AND THEIR POSSIBLE RELATIONSHIP TO COLI-SEPTICEMIA

Western College of Veterinary Medicine
Saskatchewan University
Saskatoon, Canada
H. C. Carlson, and G. R. Whenham
Avian Diseases, Vol. 12, p. 297-302, 1968. 1 fig, 15 ref.

Descriptors: *Coliforms, *Bacteria, *Poultry, *Dusts, Stress, Mortality, Humidity, Filters
Identifiers: *Chickens, *Broiler house, *Coli-septicemia, *Air sampling

This project was initiated to determine any relationship between increasing levels of visible dust in the broiler houses, any increase in total bacteria and coliform counts, and the coli-septicemia condition which appeared in the flocks. Six broiler houses were selected for the air sampling and humidity studies. Four of these were large dirt-floor houses holding approximately 11,000 birds each, while two were small houses with concrete floors capable of holding 5,500 birds. The coliform count began at 0 and then rose steeply, reaching a maximum of approximately 33 organisms per cubic foot of air between 2½ and 3 weeks. The level then dropped sharply to 8 organisms per cubic foot at approximately 6 weeks, when it again began to rise, reaching 30 organisms per cubic foot at nine weeks. The total count began at 0 and rose until about 6 weeks, at which point there was an average of 360,000 organisms per cubic foot. Then it dropped and leveled off at 9 weeks at approximately 200,000 organisms. Various factors (such as vaccination, chilling, overheating, crowding, deficient ventilation, rapid growth, change of feed, and inclement weather) have been suggested as stress factors which could complicate an E. coli infection. (Cartmell-East Central)

1470 - B1, D1, E1

SWINE HANDBOOK HOUSING AND EQUIPMENT

Midwest Plan Service, Swine Housing Subcommittee
Midwest Plan Service, Iowa State University, Ames, Iowa, 1972, 84 p. 130 fig.

Descriptors: *Hogs, *Equipment, Buildings, Ventilation, Waste disposal, Waste treatment, Waste storage, Materials, Feed lots, Confinement pens
Identifiers: Housing, Fencing, Feeding, Fasteners

This handbook summarizes what agricultural engineering can offer swine producers. It deals with the design and operation of the buildings and equipment necessary for a profitable swine business. The following are discussed in detail: production alternatives; building selection; ventilation; waste disposal; fencing; handling equipment; feeding, materials; and fasteners. Construction diagrams are included. (Cartmell-East Central)

1471 - A8, B1

CONTROL OF FLIES AROUND FEEDLOTS

Texas Area Extension Entomologist
B. C. Clymer
Texas A&M University, Texas Agricultural Extension Service, College Station, Great Plains Feeding Handbook, L-1100, p. 7802.1-7802.2, March, 1973.

Descriptors: *Feed lots, *Farm wastes, *Larvicides, *Chemcontrol, *Insecticides, Drainage, Sprinkling
Identifiers: *Flies, *Fly control, *Waste management

Control of common houseflies around feedlots presents feeders quite a problem. Effective housefly control requires proper animal waste management and good feedlot sanitation. Feedlots should be designed to allow proper drainage areas and prevent areas of waste accumulation. The best means of control is prevention of fly breeding areas. Pen drainage should be such that "wet spots" are avoided. Manure and spilled feed should be removed from fly breeding areas. Chemical control should be used in conjunction with proper waste management techniques and not as the sole means of control, Larvicides should be applied to areas of intense larval development, whereas residual and space sprays should be used to control adult flies. If sprinkling is used to relieve cattle heat stress or to control dust, efforts should be made to make sure sprinkler heads do not leak. The control and prevention of flies is not an easy problem to overcome, but good management of pen areas and of waste control go a long way toward alleviating the problem. ((Russell-East Central)

1472 - D1

INFLUENCE OF LEVEL OF DEHYDRATED COASTAL BERMUDAGRASS OR RICE STRAW ON DIGESTIBILITY

Louisiana Agricultural Experiment Station
Crowley
T. W. White, F. G. Hembry, and W. L. Reynolds
Journal of Animal Science, Vol. 38, No. 4, p. 844-849, April, 1974. 1 fig, 4 tab, 17 ref.

Descriptors: *Bermudagrass, Cattle, Energy, Feeds, Farm wastes, Drying, Sampling, Chemical analysis
Identifiers: *Dehydrated coastal bermudagrass, *Rice straw, *Digestibility, Roughage

Digestion trials were conducted on steers with rations that contained various levels of dehydrated Coastal bermudagrass or rice straw. The objective of these studies was to determine the influence of roughage level on total ration digestibility. The rations contained 0, 20, 40, 60, 80, or 100% bermudagass in trial 1 and rice straw pellets in trial 2. As the level of Coastal bermudagrass increased there was a linear decrease in energy, dry matter, organic matter, nitrogen-free extract, and ether extract digestibility. With increase in rice straw, a linear and quadratic decrease was observed in the digestibility of all nutrients except crude fiber and ether extract. As the rice straw level increased, crude fiber digestibility increased with linear, quadratic and cubic effects significant. Ether extract digestibility was not influenced by level of rice straw. The type of roughage did not appear to influence energy digestibility at the 20% level but as the level increased the decrease in digestibility was more rapid for rice straw. (Cartmell-East Central)

1473 - E3

DIGESTIBILITY OF FEEDLOT WASTE

Oklahoma Agricultural Experiment Station
R. R. Johnson
Animal Science Research, p. 62-65, 1972. 5 tab.

Descriptors: *Feed lots, *Farm wastes, *Recycling, *Feeds, Cattle, Sheep, Ruminants, Proteins, Organic matter, Oklahoma
Identifiers: *Digestibility, Dry matter, Nutritive value

An experiment was initiated to investigate the nutritive value of feedlot wastes as a component of rations for ruminant animals. Three samples of feedlot wastes were obtained from typical feedlot operations. The first was a sample from the mound of material, the second from feedlot waste from a growing lot and the third from a finishing lot. The feedlot wastes utilized in these experiments were extremely high in ash content varying from 35 to 43.5 percent. The crude protein content varied from 15-19 percent. Digestibility of the dry matter varied from 35 to 50 percent and the organic matter, from 42 to 56 percent. The digestible protein content of the feedlot wastes was quite high. Further analyses are being made on these rations and the feces from the animals in the digestion trial to determine the true digestibility of the energy in the ration to confirm the results given. (Cartmell-East Central)

1474 - D1

DOUGLAS FIR BARK AS A TRICKLING FILTER MEDIUM FOR ANIMAL WASTE DISPOSAL SYSTEMS

M. G. Cropsey, and P. H. Weswig
Technical Bulletin 124, Oregon State University Agricultural Experiment Station, February, 1973, 11 p., 9 tab., 9 ref.

Descriptors: *Douglas fir trees, *Bark, *Trickling filters, Farm wastes, Waste disposal, Biological oxygen demand, Nitrogen, Phosphorus, Turbidity
Identifiers: *Animal waste disposal systems, Total solids

Douglas-fir bark, 3/4 inch and 1½ inch in size, was tested in recirculating trickling filter 1, 2, and 3 feet in depth, hydraulically loaded at 2.27, 4.54, and 9.08 gallons per minute per square foot (gpm/sq.ft.) with 2 and 4 percent poultry manure slurry at 70°F. Preliminary tests indicated the necessity of allowing the heavier waste particles to settle by gravity. Samples collected at the beginning and at intervals during the run indicated that the reduction of biological oxygen demand (BOD) followed close to the formula BODt=$BOD_0$10-kt. Also, as the depth of filter and the rate through the filter increased, the rate of removal of total solids increased. However, the rate of flow through the filter had little effect upon nitrogen removal, as this was influenced by the length of time circulated and the depth of the filter bed. BOD and the total solids concentrations lowered at a faster rate when the larger bark was used. There was no indication that the bark increased in either nitrogen or phosphorous during the tests. The turbidity on an average improved from 75 to 4.3 JTU (Jackson turbidity units) for the 2 percent concentrations and from 157 to 16.4 JTU for the 4 percent concentrations in 23 hours. (Cropsey and Weswig-Oregon State University)

1475 - B1, F2

POLLUTION CONTROL REGULATIONS FOR CATTLE FEEDING STATES

Oklahoma State University
M. Paine, and J. Sweeten
Feedlot Management, Vol. 15, No. 12, p. 42-44, November, 1973, 1 fig.

Descriptors: *Air pollution, *Cattle, *Runoff, *Waste water disposal, Feed lots
Identifiers: Feeding

In 1972, Congress passed the Federal Water Pollution Control Amendments Act which gave the Environmental Protection Agency new powers to control discharges from feedlots. Effective July 5, 1973, feedlots with a capacity of 1,000 head were to be required to apply for a permit to "discharge" into navigable waters. By October 18, 1973, EPA was supposed to establish "effluent limitations" for existing feedlots and "standards of performance" for new feedlots. This would mean that no water from the feedlot should enter public waters, unless an unusually large storm causes runoff. EPA's draft report proposed no discharge of process waste waters to navigable water bodies by July, 1977, except for precipitation events in excess of the 10-year, 24-hour storm. By 1982, no discharge would be required except for precipitation events in excess of the 25-year, 24-hour rainfall. All new feedlots would be required to contain the 24-year, 24-hour rainfall. (Drewry-East Central)

1476 - A1, A6, E2

IOWA WATER POLLUTION CONTROL COMMISSION

Iowa State Department of Health
Des Moines
U. Agena
Iowa Water Pollution Control Commission, 1971, 13 p. 5 tab.

Descriptors: Water pollution control, *Air pollution, Odor, Pollutants, Livestock, Poultry, Confinement pens, Regulation, Iowa, Permits, Waste disposal, Agricultural runoff
Identifiers: *Iowa Water Pollution Control Commission, Confinement feeding

Iowa has established separate agencies to deal with air and water pollution. The Iowa Air Pollution Control Commission has authority to regulate air pollutants, including odorous substances. Its activities are presently concentrated on establishing and enforcing regulations to control air pollutants felt to have public health implications. The Iowa Water Pollution Control Commission was established to prevent, abate, and control water pollution throughout the state of Iowa. Increased attention is now being given toward control of pollution caused by livestock and poultry operations. Copies of the existing Iowa Water Pollution Control Commission cattle feedlot regulations and the proposed regulations for other animal feeding operations are attached. The regulations are divided into two major types of operations, open feedlot and confinement feeding operations. These are defined and regulations are given in detail for both. (Cartmell-East Central)

1477 - A1, B1, D1, E1

AGRICULTURE WASTE UTILIZATION VERSUS DISPOSAL

Management Consultant
DEKALB AgResearch, Inc.
DeKalb, Illinois

Descriptors: *Waste disposal, *Farm wastes, *Agriculture, Livestock, Poultry, Drying, Odor, Sludge, Nitrogen, Phosphorus, Moisture, Lagoons, Feeds, Recycling, Waste treatment, Methane, Research and development
Identifiers: *Waste utilization

The problem of agricultural waste disposal is a four point problem of: bird and animal concentration; changes in management systems; urban society moving to the source of production; and an awareness of society's right to clean air and water. Most people feel that keeping manure dry is the only method that should be used for maintaining odor control. This may be done by transferring moisture away from the manure particle by air movement and/or heat. If composting would take place within the building, the water from the fresh manure could be utilized for the aerobic bacteria. Handling manure wet, or by the hydraulic method is the easiest and simplest way of getting it out of the house. The problem is the anaerobic or septic odors in the lagoon or on spreading of the sludge on the land. A plastic bubble might be put over the lagoon to collect the methane gas for the operation of the electric generation equipment for the farm. The true value of all the manure produced by laying hens in the United States, based on 8 cents/pound of N, 6 cents P, and 6 cents K, is $40,000,000/year, besides the value of trace elements and humus. Livestock wastes could be pasteurized and processed so they could be a source of feed nutrients. Michigan State has indicated in a preliminary report that it appears that processed poultry nutrients are about equal to corn in value with no residue of either pathogens or chemicals. (Solid Waste Information Retrieval System)

1478 - A5, B3, D1, E3

FARMS ARE NOT OUT IN THE COUNTRY ANY MORE

Communications Center
New Jersey Agricultural Experiment Station
C. J. Teller
Compost Science, Vol. 11, No. 1, p. 8-9, January-February, 1970, 2 fig.

Descriptors: *Waste disposal, *Livestock, *Farms, *Farm wastes, Recycling, Aeration, New Jersey, Research and development, Dairy industry, Hogs, Odor
Identifiers: *Suburban areas, Land disposal, Composting, Soil conditioner, Plowing

Dairy farms in New Jersey adjoin industrial parks and only the width of a highway separates a South Jersey hog farm from a new housing development. A series of projects is being carried out at the Rutgers College of Agriculture and Environmental Science concerning the problems of agricultural solid wastes in today's suburban society. A special "Animal Waste Disposal Task Force" was organized with representatives from 23 local, State, and Federal public and private agencies and organizations interested in animal waste disposal. Environmental scientists, engineers, and soil chemists are studying the feasibility of incorporating manure into the soil. Equipment has been developed for making a furrow, placing manure in it, then covering the manure and opening another furrow all in the same operation. The feasibility of composting manure has also been investigated. The first trial is now under way, utilizing a roto-shredder to aerate the windrows. It is not expected that composting will turn out to be a profit-making venture. Dairy and hog farmers may have to sell it at about half what it costs to make it in order to dispose of manure. The composition of odors and flavors is being studied and a project that will utilize fungi to convert carbohydrate waste into protein supplement is being considered. Walker-Gordon Farm in Plainsboro has been drying manure, mixing it with cocoa shells to deodorize it, and selling the mixture as a soil conditioner. (Solid Waste Information Retrieval System)

1479 - B1, E2

CHICKEN MANURE: AN EFFECTIVE, SAFE RANGELAND FERTILIZER

M. Franz
Compost Science, Vol. 12, No. 2, p. 14-15, March April, 1971. 1 fig, 1 tab.

Descriptors: *Poultry, *Farm wastes, *Fertilizers, Costs, California, Forage grasses, Waste disposal
Identifiers: *Chicken manure, *Rangeland

A report entitled 'Fertilization of Annual Rangeland with Chicken Manure' is summarized. Four plots were treated with: (1) no fertilizer; (2) one ton chicken manure per acre; (3) two tons; and (4) four tons. The mean yields in excess of the control plot (1) were (2) 1,422 lb; (3) 2,263 lb; and (4) 3,533 lb. To spread the poultry manure on land costs from $3.10 to $4.35 per ton. The extra feed has a value of $5.00; thus a profit can be realized. The forage produced is of a higher quality, and is available for longer periods. This type of fertilization shows promise in areas close to a source of supply. (Solid Waste Information Retrieval System)

1480 - A1, E2

FATE OF NITRATE FROM MANURE AND INORGANIC NITROGEN IN A CLAY SOIL CROPPED TO CONTINUOUS CORN

Department of Plant and Soil Science
Vermont University
Burlington
J. M. Kimble, R. J. Bartless, J. I. McIntosh, and K. E. Varney
Journal of Environmental Quality, Vol. 1, No. 4, p. 413-415, October-December, 1972. 5 fig, 1 tab, 6 ref.

Descriptors: *Nitrates, *Farm wastes, Nitrogen, Fertilizer, Crops, Leaching, Denitrification, Sampling, Soil profiles
Identifiers: *Manure, *Corn, *Inorganic nitrogen, *Clay soil

Effects of dairy manure and nitrogen fertilizer were studied on plots that had received in a factorial arrangement two levels of manure (0 and 66 metric tons per hectare) and two levels of nitrogen (0 and 224 kg per hectare) applied every spring for 6 years. Laboratory incubation studies using soil profile samples showed potential denitrification to be greater in soil from the manure treated plots than in plots receiving either inorganic nitrogen or no nitrogen. The amount decreased with depth to 96 cm, below which energy for anaerobic microbial activity appeared to be limiting. Laboratory analysis of profile samples indicated decreasing nitrate-nitrogen-to-chloride ratios at all depths from fall to spring, suggesting that denitrification rather than leaching was responsible for a significant portion of the nitrate loss during this period. Abrupt decreases in the nitrate-nitrogen-to-chloride ratios from the surface to the 45 to 71 cm depth indicated that denitrification had taken place and that a nitrate bulge at 96 to 122 cm probably was caused by denitrication above that depth. The results indicate that more nitrate was lost by leaching when nitrogen was applied as ammonium nitrate than when applied as dairy manure, both because there was more nitrate in the profile and because it was less susceptible to denitrification. (Solid Waste Information Retrieval System)

1481 - E2

FERTILIZERS, CROP QUALITY, AND NUTRIENTS IN WASTES

J. Goldstein
Compost Science, Vol. 14, No. 3, p. 9-11, May/June, 1973.

Descriptors: *Fertilizers, *Crops, *Nutrients, *Farm wastes, Organic wastes, Agriculture, Waste disposal, Foods, Quality control
Identifiers: *Crop quality, Composting, Chemical fertilizers, Health, Soil conditioner

This article describes a study being conducted at West Virginia University on what effects fertilizer applications have on plant composition and the animals consuming the food. Early findings raise questions about deficiencies developing in foods that can cause widespread human health problems. The American public is being alerted to the problem by being shown the direct effect of fertilizers on the food it is buying. A survey of the literature is provided which presents varied viewpoints on the use of chemical fertilizers. (Solid Waste Information Retrieval System)

1482 - A5, B3, C1, D4

INDIANA POULTRYMEN ARE COMPOSTING POULTRY MANURE

Extension Poultryman
Purdue University
Lafayette, Indiana
J. G. Berry
Compost Science, Vol. 12, No. 1, p. 4-5, January-February, 1971. 3 fig.

Descriptors: *Poultry, *Farm wastes, Costs, Indiana, Waste treatment, Odor, Waste storage, Ventilation, Aeration, Waste disposal
Identifiers: *Composting, *Manure, Flies, Deep-pit system

Poultrymen in Indiana have found a method of composting poultry manure that reduces labor costs, and virtually eliminates fly and odor problems. Laying hens are housed in cages or on slats above storage pits in which the droppings are collected. If the pit is kept dry, there is no odor at all. One pit, in operation for 6 years, had a 34-in. deep compost, which was dry to a depth of 18 in., and moist below. This system is generally successful, and where problems occur, they are not as great as those resulting from handling manure by 'conventional' methods. (Solid Waste Information Retrieval System)

1483 - A4

GROUND WATER POLLUTION IN THE SOUTH CENTRAL STATES

National Ground Water Research Program
Robert S. Kerr Environmental Research Laboratory
Environmental Protection Agency
Ada, Oklahoma
M. R. Scalf, J. W. Keeley, and C. J. LeFevers
Environmental Protection Agency report number EPA-R2-73-268, June 1973. 183 p. 23 fig, 15 tab, 387 ref.

Descriptors: *Ground water, *Water pollution, Water resources, Natural pollution, Oil-field brines, Over-pumping
Identifiers: *South-Central United States, Arkansas, Louisiana, New Mexico, Oklahoma, Texas

A study was conducted to determine the groundwater pollution problems in the states of Arkansas, Louisiana, New Mexico, Oklahoma, and Texas. Information was obtained through review of the literature and through interviews with engineers, scientists, and government officials concerned with water pollution in the five states of the project area. Natural salinity was the greatest factor affecting the quality of ground water of the region. Disposal of oil-field brines was the most widespread source of man-made pollution. Other causes of groundwater pollution included poor well construction and abandonment procedures, over-pumping, irrigation return flows and land disposal of solid and liquid wastes. (Scalf-R. S. Kerr Environmental Research Lab.)

1484 - E2

FERTILITY

Crops and Soils Magazine, Vol. 25, No. 1, p. 28, October, 1972. 1 fig.

Descriptors: *Fertility, *Fertilizers, *Waste disposal, Economics, Cattle, Waste storage, Agriculture, Nitrogen, Phosphorus, Potassium
Identifiers: *Manure, Chemical fertilizers, Spreading

This article discusses manure's cash value as a fertilizer. One cow will produce about 15 tons of manure per year which contains nitrogen, phosphorus and potassium. If one purchased this much fertilizer commercially it would cost about $30. However, when manure is spread in the open almost any time of the year it will lose about a third of its original value. Spreading the manure in the winter will increase the losses. The main losses come from spreading, not storing, so it is best to plow the manure down as soon as possible after spreading. Therefore, the best method to use would be to store the manure all year and spread it just before fall plowing. (Solid Waste Information Retrieval System)

1485 - B1, D4

TREATMENT OF AGRICULTURAL WASTES

E. R. E. Briscoe
Effluent Water Treatment Journal, Vol. 9, No. 8, p. 439-446, August, 1969. 3 tab.

Descriptors: *Waste treatment, *Farm wastes, *Livestock, Slurries, Lagoons, Oxidation Lagoons, Aeration, Drying, Food processing industry, Irrigation, Water pollution
Identifiers: *Great Britain

Wastes from livestock farming and from vegetable washing and packaging are of immediate concern because of the nature of the latter polluting material and the large volume of liquid used in the process. The four general methods of dealing with the excreta from livestock in Great Britain are: dry-handling, semi-dry handling, semi-liquid handling, and liquid manure irrigation. It has been demonstrated by practical experiment that comparatively simple forms of extended aeration systems are capable of dealing with the slurries from calves, pigs, and hens. Other experiments have involved a combination of lagoon with oxidation ditch below slatted floors of a pig house, an aeration system using large bubbles, poultry manure drying, and a portable oxidation ditch. The waste from vegetable washing and packing is largely seasonal and varies considerably in strength. The practice of passing this type af waste through settlement is no longer providing a satisfactory solution. From research work, it would appear that pre-screening down to 52 or even 100 mesh is worthwhile in the case of all root crops. Biological treatment could take the form of extended aeration, or high-rate filtration units using plastics medium with re-circulation, in each case possibly followed by lagoons. (Solid Waste Information Retrieval System)

1486 - A4, B1

REDUCING FEEDLOT NITRATES IN YOUR GROUND WATER

J. R. Watson
Crops and Soils, Vol. 24, No. 3, p. 17-18, December, 1971. 4 fig, 1 tab.

Descriptors: *Nitrates, *Feed lots, *Groundwater pollution, Soil profiles,, Nebraska, Leaching, Sampling

The U.S. Department of Agriculture, the Agricultural Research Service and Soil and Water Conservation scientists, and the Department of Agronomy at the University of Nebraska have been studying the movements of nitrates and other solubles in soil profiles under beef cattle feedlots. In general, oxygen and nitrogen concentrations are considerably depleted, while carbon dioxide and methane are plentiful. The ammonium-nitrogen and total nitrogen concentrations are higher near the surface, although there were no nitrates found. To guard against the possibility of nitrate leaching, however, the following procedures are recommended to all cattle farmers: avoid frequent and excessive scraping of the feedlot surface, and leave the surface soil relatively undisturbed when removing manure from the feedlot. On-lot decomposition is encouraged. In this way, leaching of the soil will be minimized as will its oxygen concentrations. Low oxygen concentrations are desirable since oxygen interferes with the reducing environment in which nitrates are converted to harmless nitrogen gas. (Solid Waste Information Retrieval System)

1487 - B2, D1, E1

BIOLOGICAL TREATMENT OF POULTRY MANURE REDUCES POLLUTION

Harni Road
Baroda, India
J. D. Patel, and R. B. Patel
Compost Science, Vol. 12, No. 5, p. 18-20, Sept.-Oct., 1971. 2 fig.

Descriptors: *Waste treatment, *Farm wastes, *Poultry, *Biological treatment, *Aerobic conditions, Anaerobic conditions, Gases, Fuels, Effluent, Fertilizers, Odor, Flies, Reclamation.
Identifiers: *Manure, *Pollution, India, Digestor, Malaria, Pollution control

Animal and poultry wastes can be converted either aerobically or anaerobically into valuable soil amendments, with the former method being used for wastes with low organic solids. With the latter method, which is used to treat poultry manure at Papcock Farms of Baroda-6, India, the manure is mixed with water, after which it undergoes a 3-day digestion process consisting of first liquification then gasification. The gaseous end-products are primarily carbon dioxide and methane, with small quantities of ammonia, hydrogen sulphide, nitrogen, hydrogen and oxygen. These gases are utilized as fuel to run the incubator with a capacity of 4,224 eggs, a small gas engine, the incubator fans, and in domestic cooking. A low BOD effluent is also produced, which has no odor and can be diverted to a municipal sewer, or sold as farm manure. As a fertilizer, the effluent provides a stable, well-balanced product, which contains humus nitrogen-giving blue-green algae are used on the drying effluent to increase the nitrogen content of the final product, and to prevent the breeding of the malaria carrier. Further, the digestion process destroys all fly larvae and pathogenic organisms, as well as rendering end-products which do not contribute to air, ground-water, or soil pollution. The operation of the digestor is described in detail. (Solid Waste Information Retrieval System)

1488 - B3, D1, E2

NEW USES FOR POULTRY MANURE?

Compost Science, Vol. 11, No. 4, p. 19, July-August, 1970.

Descriptors: *Poultry, *Farm wastes, *Recycling, Feeds, Fertilizers, Ventilation, Drying, Organic wastes
Identifiers: *Great Britain, Composting, Soil conditioners

In Great Britain, poultry droppings are being fed to sheep and beef cattle in diets containing 12½ and 25 percent dried manure, while derelict, abandoned lands around coal fields are being reclaimed and restored through manure application. New developments in poultry house ventilation and management are drying poultry manure as well as the litter so that the total moisture content of the product is less than 30 percent to 20 percent by weight. This drying in the house encourages the action of aerobic bacteria and composting to take place. Dry manure is being sold in bulk to mix with other organics to improve a mix of bagged organic fertilizer. Most Pennsylvania poultrymen still use poultry manure as a soil conditioner along with lesser amounts of commercial fertilizer on farm crops. Poultry manure dried in the poultry house shortly after it is produced has the highest fertilizer value that any poultry manure can have. Dry poultry manure causes fewer farm problems with flies, odor, gas and spreading than wet or liquid manure. Using the manure as feed, there are obvious dangers of transferring diseases from poultry to other livestock. Also, the animals would have to be given time for the microflora of the rumen to adjust to the new diet. Researchers at a center of the National Agricultural Advisory Service at Llanishen, Cardiff, began with glasshouse experiments, mixing Italian rye grass with battery hen slurry and applying it to tip material on a tray. Germination was poor initially. But when broiler litter was tested in the same way, germination was as good as with conventional fertilizer. (Solid Waste Information Retrieval System)

1489 - B2, D4, E3

MANURE POWER — AN OVERLOOKED ENERGY SOURCE

D. A. Harter
Pennsylvania Township News, p. 28-30, October, 1973. 3 fig.

Descriptors: *Energy, *Farm wastes, *Methane, *Waste treatment, *Waste disposal, *Recycling, Cattle, Poultry, Water, Sewage bacteria, Ornanic wastes, Pennsylvania, Vermont
Identifiers: *Manure, *Anaerobic digestor, Ignitable gas, India, South Africa

The Environmental Improvement Committee for Pennsylvania Agricultural Progress Days (held August 28-30 in Hershey) built an experimental, anaerobic digestor to demonstrate the process of converting animal manure to methane gas. They started with 30-, 40-, and 50-gallon steel drums, some angle irons, a few gas pipe fixtures, a gas light element, an electric heating element, some chicken manure, and began to assemble a generator. After research and experimentation, they found that the gas produced by their slurry was about 72% methane, 18% carbon dioxide, and 10% other gases. A "log" record indicated an average daily production of about 2.5 cubic feet of gas throughout the six-week period needed for complete digestion of the organic wastes. Experimental data showed 10 cubic feet of methane could be generated from two to three pounds of dry animal waste. (Ballard-East Central)

1490 - B1

A MATHETICAL SIMULATION OF ENVIRONMENTAL CONTROL IN SWINE BUILDINGS

L. D. Good
M. S. Thesis, Purdue University, Department of Agricultural Engineering, 1971. 58 p. 2 fig, 9 tab, 15 ref, 5 appendices
Descriptors: *Environmental control, *Swine, *Buildings, *Mathematical models, Mathematical studies, Confinement pens, Computer models, Computers, Temperature, Humidity, Heat, Ventilation, Weather, Input-output, Analysis
Identifiers: *Mathematical simulation, Experimental data

The objective of this project was the development of a mathematical model and computer program to facilitate the simulation of the environment in confined swine buildings. An additional objective was the design of input and output forms and formats to make the model accessible to interested persons. On the basis of outside temperature and relative humidity, the building, ventilation control and habitation, the mathematical model which has been developed will predict the inside temperature, relative humidity, the occurrence of condensation on walls, weight gained by the livestock and the amount of energy utilized for ventilation and heating. Input and output forms were designed to facilitate the use of this model by persons not necessarily familiar with or having access to computer facilities. The input forms allow the model to be flexible while the output attempts to present the results in a simple concise form for use by non-technical people. (Cartmell-East Central)

1491 - B1, D4, E3

METHANE RECOVERY FROM CHICKEN MANURE DIGESTION

C. W. Savery and D. C. Cruzan
Journal Water Pollution Control Federation, Vol. 44, No. 12, p. 2349-2354, December, 1972. 2 fig, 9 ref.

Descriptors: *Methane, *Poultry, *Farm wastes, *Digestion, *Waste treatment, *Waste disposal, *Recycling, Anaerobic conditions, Aerobic conditions, Drying, Incineration, Thermophilic bacteria, Energy
Identifiers: *Manure, Total energy system

To provide preliminary design data for a farm total energy system fueled by methane produced by bacteria, an experimental anaerobic digester was built and daily gas production rates and compositions were determined for loadings of fresh chicken manure. Fresh chicken manure was digested in an experimental 35-1 capacity anaerobic digester. Batch reactor operation in the thermophilic bacteria range at 51°C produced 130 1 of gas (69 percent methane)/kg of wet manure reacted. Attempts to operate the anaerobic digester at 51°C in a continuous flow, well-stirred mode with hydraulic retention times of 4, 5, and 6.7 days resulted in retarded digester operation. Anaerobic processing in conjunction with aerobic digestion, drying, or incineration offers promise of economic waste treatment of chicken manure, particularly if incorporated with a farm total energy system fueled with the recovered methane. (Cartmell-East Central)

1492 - B3, E3

BROILER LITTER SILAGE FOR FATTENING BEEF ANIMALS

Department of Poultry Science
Texas Agricultural Experiment Station
Texas A&M University
College Station, Texas
C. R. Creger. F. A. Gardner, and F. M. Farr
Feedstuffs, Vol. 45, p. 25, January 15, 1973. 4 tab.

Descriptors: *Waste disposal, *Feeds, Cattle, Poultry, Recycling, Pathogenic bacteria, Fermentation
Identifiers: *Broiler litter silage, Drugs, Trace minerals, Fattening

Broiler litter on pine shavings was ensiled at 35-38 percent moisture content in an airtight silo for six weeks then fed with a 12 per cent protein mix ad libitum to heifers for 120 days. The calves gained 2.54 lb per head per day. No drug carryover of any consequence occurred. Pathogens were eliminated by the heat of ensilage. A taste panel expressed some preference for steaks from control cattle but found the litter-fed beef highly acceptable. (Whetstone, Parker, and Wells — Texas Tech University)

1493 - B1

MEADOW FORAGE QUALITY, INTAKE, AND MILK PRODUCTION OF COWS

Department of Animal Science
Colorado State University
C. L. Streeter, et. al.
Journal of Range Management, Vol. 27, No. 2, March 1974, p. 133-135, 1 fig, 3 tab, 15 ref.

Descriptors: *Forage grasses, *Cattle, *Nutrients, Sampling, Nitrogen, Diets, Colorado
Identifiers: *Meadows, *Milk production, In vitro digestibility, Dry matter, Animal wastes, Bluegrass, Chromic oxide

This study was conducted to determine seasonal changes in nutritive value of forage consumed and the amount of milk produced by four breeding groups of cows grazing native mountain meadows. The experimental area was located 6 miles north of Gunnison, Colorado. Nutrient concentration and digestibility were measured. Fecal excretion was estimated using chromic oxide as an external indicator. Milk production was measured every 14 days by measuring calf weights before and after nursing, followed by weighing milk obtained by machine milking. Continuously grazed irrigated meadows produced forage high in nitrogen. There was little or no decline in dry matter intake as the season progressed. Continuous grazing of the meadow could eventually reduce the vigor of bluegrass because of heavy pressure on bluegrass sites. Conclusions concerning differences among breeding groups were given but must be regarded as tentative because of limited numbers. (Cartmell-East Central)

1494 - B3, D4

POWER REQUIREMENTS OF A COMPOST CHANNEL FOR ANIMAL WASTES

Agricultural Engineering Department
Maryland University
College Park
J. W. Hummel, W. F. Schwiesow, and G. B. Willson
Transactions of the ASAE, Vol. 17, No. 1, p. 70-73, January-February, 1974. 3 fig., 3 tab, 6 ref.

Descriptors: *Farm wastes, *Waste treatment, Anaerobic bacteria, Aerobic bacteria
Identifiers: *Animal wastes, *Composting, Mechanical Agitation

Composting of waste materials has been done for many years with small amounts of waste being processed at slow rates under anaerobic conditions. But research has determined that when sufficient oxygen is available, decomposition is accomplished faster and with no offensive odor when aerobic bacteria influences the process. Interest in finding a proper mechanical aerobic compostor stimulated this experiment. The experiment channel was constructed out of plywood 37 ft. long and elevated 3 ft. An elevating mechanism was designed to agitate, mix and transport the composting mass the length of the channel. The channel used in the experiment appears to be a promising system for composting agricultural wastes. Actual power measurement data indicated that the carriage used is even heavier than necessary. The artificial test material used was adequate in establishing the effects of design changes on the power requirements of the system, but actual waste material or test materials more closely resembling waste materials are necessary to determine actual power levels. (Russell-East Central)

1495 - D1, E3

THE EFFECT OF INCORPORATING HEN MANURE INTO THE DIET OF YOUNG CHICKS

Department of Poultry Science
Florida Agricultural Experiment Station
Gainesville
D. R. Sloan, and R. H. Harms
Poultry Science, Vol. 52, No. 2, p. 803-805, March, 1973. 3 tab, 4 ref.

Descriptors: *Farm wastes, *Poultry, Diets, Feeds, Proteins, Growth rates, Performance, Waste treatment, Waste disposal
Identifiers: *Refeeding, Manure, Chicks, Air-dried hen manure, Feed efficiency, Growth depression, Uric acid, Feed consumption

A study was conducted to determine the effect of adding air-dried hen manure to a chick diet. Two experiments were conducted using 720 day-old broiler-type chicks. In the first experiment, protein levels of 16, 20, and 24% were fed with five levels of hen feces. Manure was substituted on a pound for pound basis in the basal diet. Diets used in the second experiment contained either 20, 24 or 28% protein with three levels of manure, and 2 levels of sand. A decrease in growth was obtained with each increase in manure level. The incorporation of the manure at any level of protein was detrimental to weight gain. A decrease in growth and feed efficiency was obtained by adding either 5 or 10% hen manure to the feed. The addition of 5% sand did not influence growth or feed efficiency. When the level of sand was increased 10%, a significant growth depression was obtained when the diet contained only 20% protein. However, growth was not depressed at levels of 24 or 28% protein. It would appear that some factor is present in air-dried hen manure, perhaps uric acid, which masks the birds ability to eat and meet its energy requirements, thus having a depressing effect upon body weight gain and decreasing feed utilization. (Cartmell-East Central)

1496 - B1, D1, E1

MANURE, HOW IT WORKS

Civil Engineering Department
Water Resources Center
Texas Tech University
Lubbock
D. M. Wells, G. A. Whetstone, and R. M. Sweazy
Presented at the American National Cattlemen's Association—EPA, Action Conference, Denver, Colorado, August 28-29, 1973. 2 tab, 14 ref.

Descriptors: *Farm waste, *Waste treatment, *Waste disposal, Recycling, Odor, Economics, Feed lots, Cattle, Fertilizers, Chemical properties, Physical properties, Fuels, Methane, Oil, Gases
Identifiers: *Manure, *Waste utilization, Refeeding, Gas synthesis, Composition, Land disposal

Due to the large quantities of manure being produced by modern feedlots, the feeder is faced with either a huge problem or a huge potential resource. Manure can be used beneficially in a number of ways, but it has a negative value in virtually all the methods of utilization currently in widespread use. Manure is composed of a variety of compounds, and the sum product of the breakdown of these compounds is usually on odorous process. However, research is being conducted to find ways to control and decrease the negative qualities of manure. One of the most promising projects currently underway is the synthesis gas project. Other valuable projects are experimenting with direct refeeding of wastes. Other techniques have been devised for disposing of manure cheaply, and these processes will probably gain more attention until more sophisticated systems come into widespread use. (Russell-East Central)

1497 - A1, E2

MANURE GOOD 'PINCH HITTER' FOR COMMERCIAL FERTILIZER

Feedlot Management, Vol. 16, No. 4, p. 26, April, 1974

Descriptors: *Fertilizers, *Phosphorus, *Potassium, *Nitrogen, *Saline soils, *Farm wastes, *Waste disposal, Livestock, Feed lots
Identifiers: *Manure, *Land application, Loading rates

Because of rising fertilizer costs, more and more interest is being generated for using manure from livestock feeding operations as a plant nutrient source. Tests were conducted using manure as a fertilizer source and it was found that 10 to 15 tons per acre is enough for most crops and anything over 20 tons would not be beneficial. The main drawbacks of using manure as fertilizer are the high costs of hauling and applying the waste, the possibility of introducing noxious plants to uncontaminated fields, the buildup of salt in the soil, and the buildup of phosphorus in the soil. Long term effects are hard to evaluate, but at the present with moderate application rates no problems are forseen. Above all, research has indicated that with proper application and management of wastes, excellent crop growth can be achieved. (Russell-East Central)

1498 - A2, B2, E2
MENACING RUNOFF CONTROLLED WITH LAGOON SYSTEM
Feedlot Management, Vol. 15, No. 5, p. 13-14, May, 1973

Descriptors: *Agricultural runoff, *Water pollution control, *Lagoons, *Waste storage, *Waste disposal, Farm wastes, Fertilizers, Feed lots, Dikes, Settling basins, Regulation, South Dakota
Identifiers: Land disposal, Screening

Runoff from commercial feedlot operations, such as that of the Thormodsgaards in South Dakota, creates many environmental hazards. To deal with these hazards the government has passed stringent anti-pollution regulations. To meet these regulations the Thormodsgaards had to take effective control measures to correct their problem. The American Soil Conservation Service (ASCS) aided them in developing an operation which would meet these regulations. Dikes were erected which would prevent field water from running through the feedlots and the water directly from the lots was diverted to a settling basin. It was then passed through a screen into a retention pond. When the retention pond became too full, the water was pumped onto adjoining land. Each summer the settled wastes were removed and spread on land as fertilizer. The Thormodsgaards feel that the wastes are not a replacement but a supplement to their fertilizer program. Total cost of the operation is about $6,500 with ASCS paying 80% of the cost. With this type of pollution control it is hoped that feedlots will decrease their amount of pollutant discharge into streams and rivers. (Russell-East Central)

1499 - A1, B1, E1
ECONOMIC COSTS OF WATER QUALITY PROTECTION ON DAIRY FARMS
Department of Agricultural and Food Economics
Massachusetts University
M. Ashraf, and R. L. Christensen
Paper presented at Joint Regional Meeting of The Northeast Division of ADSA and the Northeast Section of ASAS, Kingston, Rhode Island, July 15-17, 1973, 18 p. 1 fig. 9 tab, 5 ref.

Descriptors: *Costs, *Economics, *Dairy industry, Waste storage, Waste disposal, Water pollution, Nutrients, Water quality control, Labor, Cattle
Identifiers: *Water quality protection, Stacking, Land spreading, Stanchion dairy operation, Freestall dairy operation

Nutrient pollution of surface waters from animal sources is a major public concern. Alternative systems of manure disposal (such as liquid storage or stacking) could be utilized to minimize the pollution effect. Such changes result in investment costs of three to five times higher than daily spreading systems. Smaller farms with a lot of pasture land experience a smaller impact on farm income as compared with larger free stall farms where pollution control systems are used. The selection of a particular system is directed by such factors as: slope of farm land, soil type, amount of rainfall, and the present level of water pollution. The choice of a system is also dependent upon imposed regulations. Once pollution regulations are imposed on a given farm, it is then possible to specify a system which would conform to these regulations and have minimum income impact. (Russell-East Central)

1500 - A5, B1
ODOR MEASUREMENT FOR LIVESTOCK FEEDING OPERATIONS
Texas Agricultural Extension Service
Texas A&M University
College Station
J. M. Sweeten, D. L. Reddell, and H. B. H. Cooper
Presented at Specialty Conference on Control Technology for Agricultural Air Pollutants, Air Pollution Control Association—Southern Region, Memphis, Tennessee, March 18-19, 1974. 25 p. 8 fig, 8 tab, 25 ref.

Descriptors: *Odor, *Confinement pens, *Farm wastes, Livestock, Air pollution, Hogs
Identifiers: *Odor control, *Odor measurement, Scentometer, Intensity, Organoleptic tests, Vapor dilution, Liquid dilution, Matching standards tests

Odors are easy to detect, but hard to solve in livestock feeding operations. The key to odor control is odor measurement. This report contains reviews of techniques used in odor detection and measurement. The methods presented which measure odor intensity include static and dynamic vapor dilution, liquid dilution, and matching standards tests. Results of experiments measuring odor intensities at cattle feedlots are presented. Also case studies involving scentometer readings are presented for a liquid manure system for swine, an open lot swine operation, and a confinement cattle feeding facility. With these case studies are conclusions and suggestions concerning effective odor abatement. Many areas of research concerning odor which need to be studied are also reviewed. (Russell-East Central)

1501 - B1, F1, F2
ECONOMIC IMPACTS OF APPLYING SELECTED POLLUTION CONTROL MEASURES ON MICHIGAN DAIRY FARMS
D. L. Good, C. R. Hoglund, L. J. Connor and J. B. Johnson
Michigan State University Agricultural Experiment Station Research Report 225, November, 1973, 12 p. 12 tab, 12 ref.

Descriptors: *Economics, *Dairy industry, *Michigan, *Agricultural runoff, Waste storage, Waste disposal, Labor, Dikes, Feed lots, Costs, Investment
Identifiers: Pollution control, Subsurface disposal, Soil injection, Stanchion housing, Open lot housing, Cold covered housing, Warm enclosed housing

The economic impact of three selected control measures was analyzed. The control measures were: (1) mandatory control of surface runoff from the production site; (2) prohibition of winter spreading of dairy wastes; and (3) mandatory subsurface disposal of dairy wastes. The net effect of the labor required for the entire year for application of these pollution control measures would be the reduction of the total annual hours of labor needed for the adjusted systems. Results from using facilities to control surface runoff indicate that production costs would be elevated. Also compliance with the no winter spreading and subsurface disposal of wastes would again elevate production costs. The effect of complying with all three pollution control measures would increase costs by twenty-eight dollars per cow on the 40-cow dairy farm, but would be less severe on larger operations. (Russell-East Central)

1502 - B3, E3
TURKEY ANAPHAGE
Department of Animal Science
Michigan State University
East Lansing
H. C. Zindel
Poultry Digest, Vol. 33, No. 384, p. 73, 76, 1 fig, 3 tab.

Descriptors: *Recycling, *Waste treatment, Chemical analysis, Performance, Phosphorus, Protein, Nitrogen, Bacteria, Calcium, Sawdust
Identifiers: *Turkey anaphage, *Poultry anaphage, *Dried poultry waste, Poultry litter, Manure

Turkey anaphage is defined as a product composed of turkey excreta that has been dehydrated to reach a moisture content of 10% or less. The dehydration is also designed to destroy any pathogenic bacteria. Poultry anaphage was fed at levels of 0, 5, 10, and 30% of the ration to commercial grade large white turkeys, from 9 to 17 weeks of age. The poultry anaphage used was as follows: calcium, 6.3% phosphorus, 2.6%; crude fiber, 15.6%; ether extract, 3.4%; moisture, 6.7%; crude protein, 19.5%; non-protein nitrogen, 1.5%; true protein, 10.3%. Body weight gain for the 9 to 17 week age period was not significantly affected by feeding poultry anaphage to these growing turkeys. Research has also indicated that dryed layer hen manure has a practical application as litter for brooding and rearing turkeys, but it was hard to manage and had an offensive odor. Turkeys reared on DPW were heavier, had fewer condemnations, and fewer breast blisters. (Russell-East Central)

1503 - B1, D1, E1, F2
WASTE HANDLING AND DISPOSAL GUIDELINES FOR INDIANA BEEF PRODUCERS
Purdue University, Animal Waste Committee
Cooperative Extension Service Report ID-84, Purdue University, Lafayette, Indiana, 1972, 13 p. 3 fig, 3 tab.

Descriptors: *Waste disposal, *Cattle, *Farm wastes, Odor, Solid wastes, Liquid wastes, Indiana, Regulation, Water pollution, Air pollution, Design, Feed lots, Pastures, Confinement pens, Waste storage, Waste treatment
Identifiers: *Waste handling, *Guidelines, Waste disposal systems, Beef producers, Land spreading, Nuisances

Indiana's confined feeding control law and pollution laws and regulations affecting beef operations are discussed in these guidelines. The pasture, feedlot, and total confinement systems are presented with tips on design and management of beef housing systems. Types of beef waste handling and storage facilities such as solid manure, liquid manure, and partial treatment manure handling systems are also discussed. Finally, guidelines for disposal of beef cattle waste products are brought out. Tips are provided concerning land application rates and odor control during disposal. It is hoped that these guidelines will aid beef producers in designing and operating an efficient and pollution free waste disposal system. (Russell-East Central)

1504 - B1, D1
LIVESTOCK WASTE MANAGEMENT SYSTEMS DESIGN AND OPERATION
Agriculture Engineering Department
Nebraska University
Lincoln
E. A. Olson
Presented at 1973 Winter Meeting, American Society of Agricultural Engineers, Chicago, Illinois, December 11-14, 1973, Paper No. 73-4539, 9 p. 12 fig.

Descriptors: *Farm wastes, *Waste treatment, *Design, *Operation & maintenance, Dikes, Waste disposal, Education

Identifiers: Waste treatment systems, Debris basin, Holding pond

Simple, practical livestock waste management systems based on sound research are proving themselves effective in controlling livestock waste in Nebraska. A well coordinated educational program including the livestock industry with state and federal agencies has helped acceptance of waste management. Most waste systems generally have a method for diversion of runoff from a feedlot; for collection of runoff which is held in a debris basin; and for pumping the basin after the solids settle. However, no matter what the type of system, it is essential to have good management to assure satisfactory operation. There are two jobs that need particular attention by the feeder to insure proper waste management. These are: (1) periodic cleaning of the debris basin, and (2) pumping of the holding pond. (Russell-East Central)

1505 - B1, E1, F2

LEGAL RESTRAINTS ON AGRICULTURAL POLLUTION

Army Corps of Engineers
Board of Engineers for Rivers and Harbors
Washington, D. C.
W. R. Walker
Agricultural Engineering, Vol. 51, No. 11, p. 636-637, November, 1970

Descriptors: *Legal aspects, Trespass, Pesticides, Water pollution, Waste disposal, Odor, Feed lots, Nitrogen, Lagoons
Identifiers: *Agricultural pollution, Liability, Chemical fertilizers, Private nuisance, Public nuisance, Pollution control, Legal restraints, Negligence

Due to use of confined livestock feeding operations, chemical fertilizers, pesticides and herbicides, and intensive irrigation, agriculture joins the cities and industries as a major source of pollution. Legal restraints to agricultural pollution usually involve either individual action whereby the injured party seeks redress for damages incurred by pollution or statutes and regulations by the State and Federal governments. The basis for recovery under common law involving individual action include actions for trespass, private or public nuisance, negligence, and strict liability. The most common defenses in agricultural pollution cases are the statute of limitations and prescription. Traditionally, the states establish water quality standards with the approval of the Federal government. New types of regulations such as agricultural zoning to control pesticides are being adopted by states in hopes that future agricultural pollution will be controlled. (Russell-East Central)

1506 - B1, D1, E1, E2

ECONOMIC AND ENVIRONMENTAL CONSIDERATIONS IN DAIRY MANURE MANAGEMENT SYSTEMS

Department of Agricultural Economics
Cornell University Agricultural Experiment Station
New York State College of Agriculture & Life Sciences
Cornell University
Ithaca
J. J. Jacobs, and G. L. Casler
Cornell University Agricultural Experiment Station Report A. E. Res. 72-18, December, 1972, 31 p. 1 fig, 4 tab, 8 ref

Descriptors: *Economics, *Environmental control, *Dairy industry, *Farm wastes, *Waste treatment, *Waste storage, *Waste disposal, Lagoons, Water pollution, Odor, Costs, Labor, Equipment, Research
Identifiers: *Questionnaires, *Manure, Flies, Waste management system

Results of the analysis suggest that almost any realistic alternative to daily spreading will increase the cost of manure handling on dairy farms, but will not necessarily decrease the environmental impacts. Preliminary attempts to measure and aggregate the environmental impact of alternative manure handling systems indicate that the difference among systems is not as great as that implied by those who have suggested that dairymen should be doing something other than daily spreading. Storage or lagoon systems are expensive and eventually result in adverse effects on the environment. This suggests further research must be done on the environmental effects of alternative manure handling before making overall recommendations on what is the appropriate system. (Russell-East Central)

1507 - B1

SEWAGE-GROWN ALGAE AS A FEEDSTUFF FOR CHICKS

Department of Poultry Husbandry
California University
Davis
C. R. Grau, and N. W. Klein
Poultry Science, Vol. 36, p. 1046-1051, 1957. 6 tab, 8 ref.

Descriptors: *Algae, *Feeds, *Algae proteins, *Poultry, Aluminum, Flocculation, Centrifugation, Neutralization.
Identifiers: *Chicks, *Sewage-grown, Acid extraction, Tolerance

Sewage-grown algae meals, which contain about 40% crude protein, have been studied as sources of protein and other nutrients for young chicks. All feeding trials were performed with White Leghorn chicks which were fed a stock diet for ten days after hatching, and were then fed the experimental diets for the next eight days. Both alum-flocculated and centrifugated samples were fed. The chicks tolerated diets containing up to 20% aluminum-free algae meal. The presence of significant amounts of aluminum in the meal depressed chick growth, Neutralization and acid extraction have been unsuccessful in removing the harmful effects of the aluminum. The presence of dark, watery droppings was the only observed adverse effect of feeding the algae meals. This condition was found with alum-flocculated and alnuminum-free meals. (Cameron-East Central).

1508 - B3, C5, D4, E3

BRIDGETON, N.J. SLUDGE COMPOSTING PROJECT—A CITY-FARM RELATIONSHIP

Biological & Agricultural Engineering Department
Rutgers University
New Brunswick, New Jersey
M. E. Singley
Compost Science, Vol. 14, No. 5, p. 18-21, September/October, 1973. 4 fig.

Descriptors: *Hogs, *Farm wastes, *Stabilization, Oxygen, Sewage sludge, Municipal wastes, Bulk density, Odors, Recycling, Plastics
Identifiers: *Composting, Windrows, Hog Manure, Vapor generation

A program, funded by the United States Department of Agriculture, was directed toward the feasibility of rapidly stabilizing swine and reducing odors. Street refuse was used on bulking materials in the process of swine waste composting. Composted refuse, manure, and sludge were turned twice daily during tests conducted by Rutgers University. Composting time was reduced from four months to six weeks. The color changed to brown as composting continued, and the material began to look shredded. As time passed, particle size was further reduced and vapor generation declined. Bulk density readings increased as the composting process proceeded. The lowest density reading, about 19 pounds per square foot, was for the windrow that bulked at the highest rate. At the end of the composting process, all windrows were up to between 40-50 pounds per cubic foot. The composted product was then used as a soil amendment. The most difficult problem was separating plastic from the composted material to be salvaged. (Cameron-East Central)

1509 - A1, B1, E2, E3

SYMPOSIUM ON ANIMAL WASTE MANAGEMENT

Symposium on Animal Waste Management, USDA Southwestern Great Plains Research Center, Bushland, Texas, January 18, 1973, 50 p. 11 fig, 8 tab, 21 ref.

Descriptors: *Farm wastes, *Waste treatment, *Waste disposal, Recycling, Feed lots, Cattle, Nutrients, Nitrogen, Salts
Identifiers: *Land spreading, *Pollution

This symposium was held to consider the problems of animal waste management, particularly in relation to beef cattle. Animal waste treatment and disposal were singled out in terms of recycling and land disposal. Various forms of recycling, i.e. refeeding, creating fuels, etc., are still largely experimental and in most cases are not yet feasible. While land spreading offers a much used means of waste disposal, over-supply of nutrients in the soil is a possible hazard. Research is still needed for development of non-polluting feasible means of disposing of animal wastes. (Merryman-East Central)

1510 - E2

EFFECTS OF CATTLE FEEDLOT MANURE ON CROP YIELDS AND SOIL CONDITIONS

USDA Southwestern Great Plains Research Center, Bushland, Texas
A. C. Mathers, B. A. Stewart, J. D. Thomas, and B. J. Blair
Symposium on Animal Waste Management, USDA Southwestern Great Plains Research Center, Bushland, Texas, January 18, 1973, p. 1-13, 6 fig, 1 tab.

Descriptors: *Feed lots, *Cattle, *Farm wastes, *Waste disposal, *Crops, Nitrogen, Salts, Rates of application, Soil profile
Identifiers: *Manure, *Soil conditions, *Yields, Land spreading

Definite conclusions cannot be obtained from this report because only one to three years data is represented. However, this data suggests that manure applications of ten tons per acre furnish adequate nitrogen for most crops without creating high salt buildup in the soil. Also, applications of ten tons per acre do not affect organic levels of the soil. Higher rates of manure can be added to soil without lowering yields, but nitrate and salts accumulate, eventually hampering crop yields. This problem can usually be alleviated by deeper plowing depths. Conclusions on manure application suggest that at just ten tons per acre, land area in even the most concentrated feeding areas is adequate to dispose of manure. In fact, only one-fourth of the grain sorghum cropland in Texas alone would have to be treated to dispose of the manure. The challenge is to develop distributing and handling systems to spread the manure on croplands most beneficially. (Russell-East Central)

1511 - B1, E2

EFFECT OF RATION ON MANURE SALT CONTENT

Texas Tech University Center at Amarillo
Pantex, Texas
R. H. Klett
Symposium on Animal Waste Management, USDA Southwestern Great Plains Research Center, Bushland, Texas, January 18, 1973, p. 26-31. 2 tab, 8 ref.

Descriptors: *Diet, *Salts, Farm wastes, Cattle, Livestock, Feed lots, Performance
Identifiers: *Manure, *Ration, *Waste management, Sodium levels, Excretion.

Data from this experiment illustrates that excessive levels of salt obtained from the diet are excreted and tend to serve no useful purpose for the nutrition of feedlot steers. Data also suggests that levels of sodium in the form of NaCL could be reduced below those normally recommended for feedlot rations without affect on annual performance. In other words, the correct amount of salt is the amount that is utilized by the animal. The excess salt serves no useful function. Also, reducing feeding levels of salt will result in lower levels of salt in solid-waste and will allow higher incorporation of manure into the soil as fertilizing material. (Russell-East Central)

1512 - A2, B2, E2

AMOUNTS, COMPOSITION, AND MANAGEMENT OF FEEDLOT RUNOFF

USDA Southwestern Great Plains Research Center
Bushland, Texas
R. N. Clark, and B. A. Stewart
Symposium on Animal Waste Management, USDA Southwestern Great Plains Research Center, Bushland, Texas, January 18, 1973, p. 32-42. 3 fig, 2 tab, 6 ref.

Descriptors: *Runoff, *Feed lots, Chemical composition, Sampling, Seepage, Evaporation, Stocking, Moisture content, Playas, Salinity, Irrigation
Identifiers: *Amounts, Rainfall-runoff relationships, Waste management

Runoff amounts and concentrations were measured from a Texas High Plains cattle feedlot at Bushland. The graphic relationship between rainfall and runoff for runoff-producing storms was linear with about one-third of the rainfall ending up as runoff. Concentrations of runoff constituents were higher than those found for cattle feedlots elsewhere. This was probably due to high evaporation and high stocking rates which result in lots containing more salt. Soil moisture samples indicated that there was no significant seepage which would pollute ground water from playas or lots. Before runoff could be used for irrigation there would have to be a dilution of about four parts well water to one part feedlot runoff. This dilution would reduce salinity below levels hazardous to crops. Any use of feedlot runoff for irrigation required a close watch on salts in the water and soil. (Russell-East Central)

1513 - A1, B1, E3, F2

FUTURE DEVELOPMENTS IN FEEDLOT WASTE MANAGEMENT

Texas Agricultural Extension Service
Texas A&M University
College Station
J. M. Sweeten
Symposium on Animal Waste Management, USDA Southwestern Great Plains Research Center, Bushland, Texas, January 18, 1973, p. 43-50. 7 ref

Descriptors: *Feed lots, *Farm wastes, Water pollution, Recycling, Fuels, Oxidation, Odor, Runoff, Air pollution, Design, Slurries, Legal aspects
Identifiers: *Waste management, *Developments, Land disposal, Refeeding, Pyrolysis, Composting, Building materials, Soil conditioners

With rapid progress being made toward abating water pollution and with the benefits and safety of land disposal of feedlot manure, remaining problems of feedlot waste management will primarily entail developing more efficient and odor-free methods of managing solid manure and polluted runoff. Recycling waste as feed offers one method, but the Food and Drug Administration has banned this method for lack of research. Many other recycling methods such as developing manure into fuel oil have been suggested. But, at the present, these methods are economically unfeasible. Perhaps one of the most restricting problems of waste management is odor. This problem has a variety of possible solutions, but most incorporate improved feedlot design. Once the problems have been satisfactorily solved or bypassed, feedlot waste management will no longer be a pollution control issue but an economic one. (Russell-East Central)

1514 - B1, F1

PRIORITIES IN SELECTING DAIRY FACILITIES

Kentucky University
Lexington
G. M. Turner
Presented at 1972 Annual Meeting, American Society of Agricultural Engineers, Hot Springs, Arkansas, June 27-30, 1972, Paper No. 72-415, 20 p. 1 tab.

Descriptors: *Feed lots, *Investment, *Priorities, *Facilities, *Dairy industry, Costs, Land, Water, Silage, Feeds, Planning, Cattle, Kentucky, Waste storage, Waste disposal
Identifiers: Manure handling, Feed storage, Field machinery

The reason for establishing priorities for dairy facilities is to determine which facilities are absolutely necessary in order for a maximum profit return of each investment to occur. The facilities are divided into two groups, (1) essential, and (2) additional. The essential facilities must be available before milk production can start and continue. The additional facilities lessen the time and labor load, but the margin of profit return is not as great. A list of each type of facility is given, along with an explanation of each. A discussion of the economics of investment of each of the facilities is included. The cost figures are averages from dairy farms on Kentucky Farm Analysis programs. (Cameron-East Central)

1515 - A4, E2

GROUND-WATER NITRATE POLLUTION IN RURAL AREAS

Illinois State Water Survey
Champaign
W. H. Walker
Illinois State Water Survey, Champaign, Illinois, 1973, 8 p. 1 fig, 3 ref.

Descriptors: *Groundwater pollution, *Nitrates, *Rural areas, Fertilizers, Farm wastes, Waste disposal, Sampling, Illinois, Chemical analysis, Aquifers, Groundwater recharge
Identifiers: Land application

Chemical analyses of samples collected throughout Illinois indicate that, especially in the rural areas, nitrate pollution of surficial aquifers is widespread. Nitrates readily enter the surficial aquifers during non-growing season precipitation recharge periods. The nitrates then slowly move through the aquifer to wells, streams, and drainage areas. However, little mixing with ground-water appears to occur. Studies also indicate that trees and plants store nitrates during the growing season and release them during non-growing seasons. In light of studies concerning nitrates, it seems necessary to curb nitrate fertilizer application during the growing season. Also application of wastes on land should be confined to non-growing seasons to prevent ultimate ground-water nitrate pollution. (Russell-East Central)

1516 - C1, D1

SEPTAGE: WASTES PUMPED FROM SEPTIC TANKS

Agricultural Engineering Department
Connecticut University
Storrs
J. J. Kolega, B. J. Cosenza, A. W. Dewey, and R. L. Leonard
Transactions of the ASAE, p. 1124-1127, 1972. 4 fig, 1 tab, 5 ref.

Descriptors: *Domestic wastes, *Septic tanks, *Sampling, Volume, Biochemical oxygen demand, Chemical oxygen demand, Physical properties, Chemical properties, Microbiology, Microorganisms, Costs, Bacteria, Hydrogen ion concentration, Odor, Color
Identifiers: *Septage, Concentration ratio

Septage disposal problems and feasible solutions vary among communities. Samples were taken from truck loads of septage brought to the Metropolitan District Commission, East Hartford, Connecticut Water Pollution Control Facility. Each sample collected was identified as to its purpose, i.e., bacteriological or physical—chemical. The following septage analyses were conducted: biochemical oxygen demand, chemical oxygen demand, pH, settleable solids, total solids, volatile solids, suspended solids, free ammonia, and organic nitrogen. Physical and visual observations were used for recording data on odor and color. Chemical and physical observations and results are discussed. When a state-wide septage disposal system is being planned or when a single disposal facility is being designed, septage volume estimates by area should be known. The costs per unit of volume for treating septage at a water pollution control facility are approximately 17 times the costs of treating sewage of the same volume. (Cameron-East Central)

1517 - A1, B1, E1, E2, F1

POULTRY WASTE MANAGEMENT ALTERNATIVES

North Carolina Agricultural Extension Service
L. B. Driggers, J. M. Falter, D. G. Harwood, G. J. Kriz, et. al.
North Carolina Agricultural Extension Service, Circular 570, September, 1973, 19 p. 1 fig, 11 tab.

Descriptors: *Poultry, *Farm wastes, *Waste treatment, *Waste storage, Waste disposal, Recycling, Drying, Economics, Pest Control, Water pollution, Soil contamination, Slurries, Lagoons, Effluent, Leaching, Nitrogen
Identifiers: Waste management, Odor control, Deep pit houses, Composting, Refeeding, Manure, Land application, Turkeys

This bulletin is designed to give waste management alternatives which will help the poultry producers meet their problems in the most practical and economical way. Producers or prospective producers who plan to renovate should look at the poultry production unit as a total system and should attempt to: (1) locate in the center of a large land tract if possible; (2) be sure that there is sufficient land available for waste disposal; (3) not locate the operation in a heavily populated area; (4) not locate the operation near drainage ditches, streams, rivers, and estuaries. The bulletin consists of five sections; alternative waste management systems, utilization and land requirements, odor control, pest control, and economics. Within the five sections the various systems of waste disposal are discussed, examples of how much waste can be applied per acre are given, suggestions are given for reducing odor and pest problems, and estimated cost data is presented. (Russell-East Central)

1518 - B1, E3

POULTRY MANURE AND MEAT MEAL AS A SOURCE OF DIETARY NITROGEN FOR SHEEP

Department of Animal Husbandry
Sydney University
Australia
J. Leibholz
Australian Journal of Experimental Agriculture and Animal Husbandry, Vol. 9, p. 589-593, December, 1969. 5 tab, 18 ref.

Descriptors: *Farm wastes, *Poultry, *Nitrogen, *Sheep, Amino acids, Energy, Performance, Waste disposal, Chemical analysis
Identifiers: Poultry manure, *Meat meal, Food conversion, Roughage, Australia, Weight gain

Because poultry manure has been found to be a potential source of nitrogen for ruminant animals, experiments were conducted to find suitable maintenance rations for sheep that were adequate in nitrogen and energy content. The experiments were designed to study the use of manure from caged layers as a source of ni-

trogen in low energy diets. Two experiments were conducted. In the first, sorghum was used as high energy source for the utilization of urea, while wheat was used in the second. Also in the second experiment hardwood sawdust was added. The experiments showed that poultry manure can be used satisfactorily as the main supplementary source of nitrogen when the sheep are fed a low protein, poor quality roughage. Results also indicated that 15% sawdust can be included in the diet of sheep without adversely affecting gain. (Russell-East Central)

1519 - A2, C3

NUTRIENT CONTENT OF BARNLOT RUNOFF WATER

U. S. Department of Agriculture
W. M. Edwards, E. C. Simpson and M. H. Frere
Journal of Environmental Quality, Vol. 1, No. 4, p. 401-405, October-December, 1972

Descriptors: *Nutrients, *Agricultural runoff, Feed lots, Farm wastes, Watershed, Nitrogen, Nitrates, Potassium, Phosphorus, Ohio, Water pollution, Sampling
Identifiers: Barnlot

Runoff from a beef cattle barnlot was analyzed to determine the concentration and transport of nitrate, total nitrogen, potassium, and phosphorus in the runoff water. The study was conducted from March, 1968 through December, 1970 and was conducted on a 60 head beef cattle barnlot. It was found that nitrate-nitrogen concentration was less than 2 mg/liter for eight months of the year with a concentration of 6 mg/liter as the highest peak. Soluble nitrogen was in a reduced form with a maximum monthly concentration of 70 mg/liter. Potassium concentration ranged 100-350 mg/liter, while phosphorus averaged less than 5 mg/liter during spring and summer with a peak of greater than 10 mg/liter in September. During the drier warm months nitrate concentration increased. All other measured elements decreased during this period when the barn was not in use. There appeared to be a high correlation between total nitrogen and temperature. (Russell-East Central)

1520 - B2, D1, F1

NEW CONCEPT CUTS COST FOR BEEF CONFINEMENT

Managing Editor
Farm Building News
D. Peach
Farm Building News, Vol. 7, No. 4, p. 1, 24-25, July-August, 1973. 6 fig.

Descriptors: *Confinement pens, *Cattle, *Costs, *Farm wastes, Economics, Waste treatment, Lagoons, Waste storage, Design
Identifiers: Beef, Flume and flush system

Plans for a beef confinement building with a new floor concept which may drastically cut the cost of the confinement feeding system have been developed by Iowa Beef Processors, Dakota City, Nebraska. The new concept eliminates the digging of a manure pit, the pit walls and floor, and the slats, replacing them with 2 inch slots and flumes under the concrete floor to catch the manure. The manure is then flushed to a lagoon. The estimated cost of such a system is about $70 per head capacity. The floor is sloped in the system to permit draining and the distance a feeder could flush manure is unlimited. The recommended confinement barn would vary from 24 to 40 ft. of cattle space, measuring from a feed bunk in one end to the other end. Further refinements are necessary, and experimentation is being conducted so that it is highly probable that confinement feeding can be accompanied for $70 per head or less in the near future. (Russell-East Central)

1521 - A5, D3

PILOT WASTE CONTROL AND ITS EFFECT ON POULTRY LITTER

Department of Poultry Science
Texas Agricultural Experiment Station
Texas A&M University System
College Station
W. F. Krueger, J. Bradley, and W. Milberger
Texas Agricultural Experiment Station Report, Department of Poultry Science, Texas A&M University, College Station, Texas, September, 1973. 8 p. 6 tab.

Descriptors: *Poultry, *Litter, *Farm wastes, Odor, Larvae, Larvicides, Waste treatment, Density, Quality control, Sampling, Air pollution
Identifiers: *Pilot Waste Control, Manure, Fly control, Chemical treatment

Odors and manure volume can be serious problems in cage layer and other types of poultry operations. Chemical treatment of manure may offer some relief to poultry operations with odor problems. A pilot study was initiated March 12, 1973, to evaluate Pilot Waste Control, a chemical with potential odor control properties. The objectives of the study were: to study the effect of chemical treatment of manure on odor; to determine the effect of litter treatment on manure density and quality; and to determine the number of treatments required to control odor and manure quality. When completed, recommendations were made. They were: (1) apply Pilot Waste Control to litter cones on a biweekly basis using the lowest recommended dilution rate; (2) add a larvacide to control fly larva; (3) use noncorrosive equipment when applying the chemical to litter; and (4) begin treatment when pullets are housed and continue through spring and early summer. (Russell-East Central)

1522 - A9, B3, C5, D4, E3

THE EFFECT OF PROCESSING POULTRY MANURE ON DISEASE AGENTS

Texas A&M University, College Station.
J. R. Howes, C. F. Hall, and W. F. Krueger
EPA Research Report 670/2-73-041, July, 1973, 31 p. 3 fig, 12 tab, 8 ref.

Descriptors: *Poultry, *Diseases, *Farm wastes, waste treatment, waste disposal, recycling, fertilizers, fungicides, Salmonella, ultraviolet radiation, litter.
Identifiers: *Manure, *Processing, Recovery, Survival, Bacteriology, Shavings, Composts, Newcastle disease, Inoculation, Solid waste disposal.

***Manure, *Processing, Recovery, Survival, Bacteriology, Shavings, Composts, Newcastle disease, Inoculation, Solid waste disposal**
Because poultry manure is an agricultural waste, methods of disposing and treating it must be found. The interrelationships between poultry manure processing, bacterial load, pathogenicity, and bird performance are poorly understood. In an attempt to deal with these problems, six experiments were conducted to compare the effects of various litter treatments on bird performance to eight weeks of age. To produce litter for broiler-type male chickens, the experimenters mixed poultry manure with other substances such as pine shavings, fresh sand, and cleaned rice hulls. Some of the mixtures were treated with a bacterial preparation. Comparisons were made of the treatments to see if the poultry manure could be incorporated into a mixture that would be beneficial to the chickens. The survival of disease agents in composted poultry waste was also investigated. Observations were recorded for each experiment. (Howes, Hall, and Krueger—Texas A&M University)

1523 - B3, E3

NUTRIENT RECYCLING BY LAYING HENS

Department of Poultry Science
Texas A&M University
College Station
J. N. Quisenberry, and J. W. Bradley
Feedstuffs, Vol. 41, No. 5, p. 19, February 1, 1969, 7 tab, 1 ref.

Descriptors: *Recycling, *Nutrients, Waste treatment, Farm wastes, Waste disposal, Drying, Litter, Performance, Poultry, Feeds, Taste, Costs.
Identifiers: *Refeeding, *Laying hens

Today many approaches are being used to find satisfactory and economical solutions to the problems of waste management. It is generally conceded that for most poultry operations, waste management problems could be solved by concentrating on methods of obtaining dry droppings and litter. The dried product could then be used in a variety of ways. One such way is by recycling the poultry waste. The experiment conducted was designed to test the feasibility of poultry nutrient recycling by refeeding laying hens. Varying proportions of waste material were included in the diets of the hens. Careful records were kept, and effect on the taste of eggs was tested. The layers fared well on litter and mortality rate was no higher than on regular rations. Also, the taste of the eggs varied insignificantly. Not only was the litter of considerable economic value when recycled, but the return appears to be more than sufficient to bear the expense of drying. (Russell-East Central)

1524 - A1, B3, F2

SOLID MANURE HANDLING FOR LIVESTOCK HOUSING, FEEDING AND YARD FACILITIES IN WISCONSIN

E. G. Burns, and J. W. Crowley
Publication No. A2418, Cooperative Extension Programs, University of Wisconsin, Madison, November, 1972, 83 p. 50 fig. 17 tab.

Descriptors: *Solid wastes, *Livestock, *Facilities, *Wisconsin, Dairy industry, Legal aspects, Planning, Design, Waste storage, Farm wastes, Poultry, Equipment, Specifications
Identifiers: *Manure,* Waste management, *Housing, *Feeding, Land spreading, Fly control, Pollution, Formulas

These guidelines for solid manure storage systems are the results of discussions, suggestions and opinions by the Wisconsin Dairy Cattle Housing Committee. It was found that, as a general rule, manure should be returned to Agricultural land, Problems which must be controlled include pollution of surface or ground water, odor, insects, aesthetic offensiveness, and lower milk quality due to contamination by manure. Dairy farmers should obtain approval from their county zoning authority and have a detailed building and management plan before beginning construction of their facilities. Also, suggestions and guidelines for constructing waste handling systems are presented. Proper management maintenance and operation of the livestock facility and the manure handling system are essential. The suggestions for construction in these guidelines can meet requirements only if combined with good management. (Russell-East Central)

1525 - B1

THE USE OF VOLATILE FATTY ACIDS FOR THE CONTROL OF MICROORGANISMS IN PINE SAWDUST LITTER

Department of Poultry Science, North Carolina State University, Raleigh.
C. R. Parkhurst, P. B. Hamilton, and G. R. Baughman
Poultry Science, Vol. 53, No. 2, p. 801-806, March, 1974. 4 tab, 13 ref.

Descriptors: *Microorganisms, *Control, *Litter, Molds, Hydrogen ion concentration, Poultry, Performance, Temperature, Moisture content, Nitrogen, Sampling, Waste treatment
Identifiers: *Volatile fatty acids, *Pine sawdust, Acetic acid, Propionic acid.

Poultry men have for years used pine shavings as a litter for growing broilers, but shavings are becoming hard to get and expensive. Pine sawdust is more readily available, but it has a history of increased disease and management problems. This study investigated the use of volatile fatty acids in the sawdust for the control of microorganisms. Acetic acid (60%) and propionic acid (40%) were mixed into fresh pine sawdust at 1% and 3% levels. Broilers were placed on the litter when one day old and reared to eight weeks of age. At eight weeks there appeared to be no significant effect on mean body weight, feed conversion efficiency, or mortality. The moisture content, final nitrogen content, and litter temperature were also unaffected by the treatments. Mold growth was retarded slightly at the 3% level for the first two weeks, and bacterial count was retarded for at least a week. The pH was reduced significantly from the control for three weeks at the 3% level and for two weeks at the 1% level. The findings suggest that pine sawdust would serve adequately as a litter material. (Russell-East Central)

1526 - B2, E2
SOME CHEMICAL AND PHYSICAL ASPECTS OF PHOSPHATE PRECIPITATION FROM ANAEROBIC LIQUORS DERIVED FROM ANIMAL WASTE TREATMENT LAGOONS

Agricultural Engineering Department
Iowa State University, Ames
C. V. Booram, R. J. Smith, and T. E. Hazen.
Presented at 1973 Winter Meeting, American Society of Agricultural Engineers, Chicago, Illinois, December 11-14, 1973, Paper No. 73-4522, 17 p. 6 fig, 2 tab, 12 ref.

Descriptors: *Chemical properties, *Physical properties, *Phosphates, *Farm wastes, Waste treatment, *Pipe flow, Lagoons, Anaerobic conditions, Irrigation, Waste disposal, Sludge, Equipment
Identifiers: *Precipitation, Minerals

To be effective, all phases of a waste management system must function efficiently. It has been found that recycling anaerobic lagoon liquid to transport manure from swine confinement pens has resulted in magnesium ammonium phosphate buildup in metal pipes. This leaves two alternatives: (1) converting to aerobic systems to oxidize ammonia or (2) developing equipment to overcome the buildup problem. Study indicates that overcoming this problem could best be accomplished by developing equipment. The buildup is a result of the metal interface which exists in the pipes. Therefore, plastic should be used in all plumbing. Some buildup will take place in plastic, but an acetic acid solution should periodically be added to control encrustation. Also irrigation equipment used to apply lagoon effluent to land will pass a lot less liquid per year than recycle equipment and will have less of a buildup problem. (Russell-East Central).

1527 - C5
NUTRIENT REDUCTION TO WASTE-WATER BY GRASS FILTRATION

Department of Agricultural Engineering
The Pennsylvania University
University Park, - -
R. M. Butler, E. A. Myers, J. N. Walter, and J. V. Husted
Presented at the 1974 Annual Meeting of American Society of Agricultural Engineers, Oklahoma State University, Stillwater, June 23-26, 1974, 12 p. 3 fig, 3 tab, 6 ref.

Descriptors: *Nutrients, *Waste water treatment, *Filtration, *Nitrates, Nitrogen, *Phosphorus, Municipal wastes.
Identifiers: *Grass filtration

Study was undertaken to determine the effects of flow rate, flow distance, application frequency, and seasonal changes on nitrate and phosphate removal for a grass filtration wastewater renovation system. Renovation was greatest with the lowest application rate and longest flow distance, as expected. Increasing application frequency reduced removal efficiency in both phosphates and nitrates. Laboratory and field studies were undertaken. In the field study no significant reduction in nitrates or phosphates were observed. The laboratory studies indicated that much longer contact times were necessary to obtain adequate nitrate renovation than were employed in the field studies. The labortory studies also developed a relationship between nitrate concentration, contact time, and temperature that can be used to estimate the detention time required for nitrate removal in grass filtration systems. (Russell-East Central).

1528 - A2, B1
CATTLE FEEDLOT HYDROLOGY

Agricultural Engineering Department
Oklahoma State University
Stillwater
A. F. Butchbaker
Presented at Oklahoma Section, American Society of Agricultural Engineers, Oklahoma State University, Stillwater, October 20, 1972, 25 p. 7 fig, 10 tab, 14 ref.

Descriptors: *Feed lots, *Cattle, *Hydrology, *Farm wastes, *Runoff, Precipitation (Atmospheric), Design, Great Plains, Pollutants, Nitrogen, Phosphorus, Chemical oxygen demand
Identifiers: Runoff control, Cattle density, Total solids

Many characteristics affect runoff from feedlots, and knowledge of feedlot hydrology is necessary to design runoff control facilities for feedlots. Runoff is variable from feedlot to feedlot, but certaian trends are evident in feedlot hydrology. Evidence was gathered from research that was conducted in the southern Great Plains area. It was discovered that approximately the first one-half inch of rainfall is stored on the feedlot surface with the rest as potential runoff. The annual runoff of most feedlots is forty to fifty percent of the annual rainfall. Research also found pollutional characteristics and solid transport characteristics of feedlot runoff. Much more research is necessary for the complete picture of runoff, but the present available information should be useful in the design of runoff control facilities and the management of disposal areas. (Russell-East Central),

1529 - C1, E3
DRIED ANIMAL WASTE AS A PROTEIN SUPPLEMENT FOR SHEEP

Michigan State University
East Lansing
P. Tinnimit, Yu Yu, K. McGuffey, and J. W. Thomas
Journal of Animal Science, Vol. 35, No. 2, p. 431-435, 1972. 7 tab, 12 ref.

Descriptors: *Farm wastes, *Recycling, *Sheep, Organic matter, Carbohydrates, Diets, Feeds, Performance
Identifiers: *Dried animal wastes, *Refeeding, *Protein supplement, Rations, Digestibility.

Analysis that indicates that 12-40% protein and 40-70% carbohydrates are possibly contained in animal feces prompted this study to obtain information on the value of the feces to supply nitrogen, dry matter, and organic matter to sheep. Four trials were undertaken with excellent results. Sheep were fed feces as 20-80% of a mixed ration. The dehydrated feces furnished from 40 to over 90% of the total nitrogen. Digestibility of this nitrogen was 44-62 percent. The sheep were fed about 11% protein with from 18-72% retention of digested nitrogen as compared to 16-65% retention for soybean meal rations. Dry and organic matter digestibility of 53 and 64%, respectively, were found for dehydrated caged layer feces. Dry and organic matter digestibilities of 58% and 69%, respectively, were found for cattle, swine, and poultry feces plus corn or corn starch, corn cobs, molasses, and minerals. Trials show that dehydrated animal feces can indeed be incorporated into the rations of ruminants with promising results. (Russell-East Central)

1530 - A4, B1
AMMONIUM, NITRATE, AND TOTAL NITROGEN IN THE SOIL WATER OF FEEDLOT AND FIELD SOIL PROFILES

Northern Plains Branch, Soil & Water
Conservation Research
Division, Agricultural Research Service
U. S. Department of Agriculture
Lincoln, Nebraska
L. F. Elliott, T. M. McCalla, L. N. Mielke, T. A. Travis
Applied Microbiology, Vol. 23, No. 4, p. 810-813, April, 1972, 1 fig, 4 tab, 11 ref.

Descriptors: *Nitrates, *Feed lots, *Soil profiles, *Soil water, *Groundwater pollution, Sampling, Aquifers, Cattle, Farm wastes
Identifiers: *Ammonium, *Total nitrogen, Fields, Mounding

Much concern has been generated in the area of possible movement of nitrogen compounds from feedlot surfaces to groundwater. With so many high density feeding operations underway today, the fear that possible groundwater pollution may occur has prompted many investigations on a level feedlot on Wann silt loam above sand. Soil water samples were taken at 46, 76, and 107 cm beneath the surface. Results of samples indicated that the feedlot contributed no more nitrate-nitrogen or ammonia-nitrogen than did an adjacent cropped field. Nitrate-nitrogen levels in soil water samples were less than 1 mg/ml. During the summer nitrate-nitrogen increased at the 15 cm depth which indicates that nitrification took place at the surface of the feedlot. However, nitrate-nitrogen levels below the 15 cm depth indicates that dentrification took place beneath the surface. (Russell-East Central)

1531 - B2, B3, E1
MANURE AND WASTE PROJECTS ON DAIRY FARMS

Agricultural Engineering Department
College of Agricultural and Life Sciences
Wisconsin University
Madison
L. A. Brooks, and T. J. Brevik
Presented at 1973 Winter Meeting, American Society of Agricultural Engineers, Chicago, Illinois, December 11-14, 1973, Paper No. 73-5543, 14 p. 23 fig.

Descriptors: *Farm wastes, *Cattle, *Dairy industry, Lagoons, Waste disposal, Design, Wisconsin, Waste storage, Experimental farms
Identifiers: *Manure, Milking parlor wastes

Many waste management problems are currently facing Wisconsin dairy farmers. Over 90% of the dairy farms in Wisconsin have less than 50 cows, and this fact prevents installation of elaborate and expensive waste disposal systems. What is needed is a low cost, but effective, means of handling dairy waste. In coordination with the University of Wisconsin, three low cost solid manure storage facilities were installed on private farms. The storage areas vary in size and construction, and each site cost $1,000 or less. From these projects, it is hoped, will come some of the answers to waste management. Another area of concern is milking parlor waste disposal. Most farmers use a conventional septic tank disposal system for discharging parlor wastes, but this hasn't proved to be effective. In 1972, University of Wisconsin Agricultural Engineers designed experimental disposal methods to be employed on private farms. Three farms installed disposal lagoons; two farms installed ridge and furrow disposal systems; and two shallow disposal beds were installed on another farm. Data obtained from these facilities during the next few years will determine their usefulness for waste management. (Russell-East Central)

1532 - B2, D4
SALMONID HATCHERY WASTEWATER TREATMENT

Consultant for Kramer, Chin, & Mayo Consulting Engineers
Seattle, Washington.
P. B. Liao.
Water & Sewage Works, Vol. 117, p. 439-443, August, 1970. 2 fig, 3 tab, 4 ref.

Descriptors: *Salmonids, *Waste water treatment, *Oxidation lagoons, *Aeration, *Fish hatcheries, Sedimentation, Pollution, Odor, Detention, Effluent, Oxygen, Nitrates, Phosphates, Filters, Biochemical oxygen demand, Water pollution, Effluents
Identifiers: *Primary settlings, Imhoff cone raceway cleaning wastes

Paul Liao recently discussed the nature of salmonid hatchery wastes and their pollution potential. The treatment methods studied for such hatchery wastes were stabilization ponds, primary settling, and aeration. In this paper, each of these methods is discussed. The results of this study show that a stabilization pond can provide BOD and suspended solids reduction on the order of 60% or more BOD loading rates of 50 lb./acre-day with detention time of about three days. Sedimentation ponds providing in excess of two hour detention time can be expected to reduce the BOD and solids removal from the effluent of raceways being cleaned by about 80%. A combination of short term aeration (an air supply rate ranging from 0.15 to 0.25 cu. ft./gal.) and an adequate detention time with (4 to 10 hr.) can reduce hatchery pollution loads by 50 to 90%. (Cameron-East Central)

1533 - B3, E3
DEHYDRATED POULTRY WASTE AS A FEED FOR MILKING COWS AND GROWING SHEEP

Department of Dairy Science
Michigan State University
East Lansing
J. W. Thomas, Yu Yu, P. Tinnimitt, and H. C. Zindel
Journal of Dairy Science, Vol. 55, No. 9, p. 1261-1265, 1972. 4 tab, 8 ref.

Descriptors: *Farm wastes, *Poultry, *Feeds, *Cattle, Sheep, Dairy industry, Waste disposal, Recycling, Diets, Performance
Identifiers: Dehydrated poultry wastes, Refeeding

Milking cows and fattening sheep were fed dehydrated feces from caged layers to determine its value as a feed and protein source. The milking cows were fed manure that would provide for 23% of the total dietary protein and 11% of the total dry matter. The sheep were fed manure to provide for 61 or 90% of total protein and 25 or 50% of total feed. The cows fed this ration produced equal amounts of milk as those fed a normal ration. Sheep gained less when fed the feces than they did when fed the normal ration. However, carcass grade of the sheep fed 25% feces was equal to those fed normally. The main advantage favoring feces is the cost. Dehydrated manure costs only $20 per 908 kg. The results show that it is feasible and economical to use manure as a feed ingredient and energy source for cows and lambs. (Russell-East Central)

1534 - E3, F1
SHORTCOMINGS AS FEED INGREDIENT

Department of Poultry Science
New York State College of Agriculture
Cornell University
Ithaca, New York
M. C. Scott
Egg Industry, Vol. 6, No. 7, p. 36, 38, 1973. 1 fig, 1 tab, 6 ref.

Descriptors: *Feeds, *Proteins, *Farm wastes, *Poultry, Dehydration, Recycling, Waste treatment, Waste disposal, Performance, Amino acids, Ammonia, Nitrogen, Phosphorus
Identifiers: *Dried poultry wastes, *Manure, Refeeding

There has long been a question about the true value of poultry waste as a protein supplement. Research has found that most of the nitrogen in pure poultry manure is not protein at all, but is a product of metabolism such as uric acid, ammonia salts, creatine, creatinine, etc. Nesheim reports that the actual protein content of poultry manure is only about 10,9% and not 30-35% as previously assumed. Young and Nesheim have found that the maximum amount of poultry waste that can be fed to poultry without affecting egg production is about 22 percent. This, in turn, would result in extra manure which must be dealt with by other waste management systems and would amount to about 75 to 80% of the total manure produced by the hens. Calculations indicate that the value of the manure is no greater than $26 per ton. Also, when fed back to poultry, the manure is not a good source of protein and is a poor source of energy. (Russell-East Central)

1535 - A1, B1
SOIL PROFILE CONDITIONS OF CATTLE FEEDLOTS

U. S. Department of Agriculture
Lincoln, Nebraska
L. N. Mielke, N. P. Swanson, and T. M. McCalla
Journal of Environmental Quality, Vol. 3, No. 1, p. 14-17, 1974. 4 fig, 2 tab, 5 ref.

Descriptors: *Soil profile, *Feed lots, *Cattle, *Farm wastes, Soils, Water pollution, Soil contamination, Organic matter, Infiltration
Identifiers: *Feedlot surfaces, *Layered soils, Interface layer

Before one can assimilate the potentials for soil and water pollution he must know the conditions and characteristics of the soil. Feedlot surfaces are unique in that the packed layer of organic matter behaves differently than other soils. The profile of feedlot soils can be described as three layers: the organic matter, the interface, and the underlying soil. The profile of the underlying soil of a feedlot has little effect on water movement into the profile or on runoff. The bulk density at the interface layer is greater in a feedlot than in cropland at the same depth. Water movement is impeded because of the compactness and effects on soil particle dispersion. The surface layer of a feedlot may absorb large amounts of water into the soil, but actual infiltration of water into the soil is minimal. When manure is present and covering an interface, nitrate-nitrogen is less likely to accumulate in the profile. (Russell-East Central)

1536 - A1, B1
THE COMPOSITION OF THE SOIL ATMOSPHERE BENEATH A BEEF CATTLE FEEDLOT AND A CROPPED FIELD

U. S. Department of Agriculture
Lincoln, Nebraska
L. F. Elliott, and T. M. McCalla
Soil Science Society of America Proceedings, Vol. 36, p. 68-70, 1972. 1 fig, 5 tab, 13 ref.

Descriptors: *Feed lots, *Cattle, *Soils, *Ground water pollution, Gases, Denitrification, Sampling, Soil profiles, Methane, Carbon dioxide, Oxygen, Nitrogen
Identifiers: Composition, Cropped field

The purpose of this study was to measure the soil gases beneath a level feedlot and a cropped field. The shallow water table beneath the feedlot had revealed NO3-N concentrations above 10/ppm only twice in a 3 year period. The soil gases beneath the feedlot were measured to discover why the feedlot was not contaminating the groundwater with NO3-N. The data revealed that the feedlot soil profile was reduced, contained organic matter, and was favorable for denitrification, at least at times during the year. The high CH4 values recorded, when precipitation was received and moderate temperature prevailed, showed anaerobic conditions. Soil core studies in the feedlot revealed low Eh values. While 02 levels increased when the feedlot was dry or frozen, significant downward movement would not be expected under these conditions, so no mechanism existed for NO3-N transport to the water table. The data also showed the feedlot soil profile to be favorable for denitrification when downward water movement would be expected. Gas data was given in detail and provided a possible explanation as to why little NO3-N reached the water table. (Cartmell-East Central)

1537 - A5, B2, D1
THE EFFECTS OF LIMITED AERATION ON THE ODORS OF LIQUID DAIRY MANURE

K. D. Vickers
Unpublished M. S. Thesis, University of Idaho, 1972, 67 p. 13 fig, 7 tab, 24 ref.

Descriptors: *Aeration, *Odor, *Liquid wastes, *Farm wastes, *Dairy industry, *Slurries, Chemical oxygen demand, Amino acids, Sampling, Hydrogen ion concentration, Ammonia, Nutrients

This study was undertaken to determine the best aeration volume that would reduce odors in liquid dairy manure storage pits without losing nutrient value in the slurry. Tests began using the volume of air that would reduce the Chemical Oxygen Demand by 10% at an 8% oxygen transfer efficiency. Two runs were then made using substantial air volume reductions. A fourth run was made without any aeration. As the aeration volume was reduced the odor increased. There was no nutrient loss during any of the experiments during which air was supplied to the manure slurry. During the experiments the manure slurry was monitored for oxidation reduction potential, drainability, ammonia, Kjeldahl nitrogen, volatile acids, oxygen, methane, pH, odor value, COD, total and volatile solids, and total phosphorus. (Russell-East Central)

1538 - B1, C3, C5
INFLUENCE OF THE CONCENTRATION AND VOLUME OF SALINE WATER ON THE FOOD INTAKE OF SHEEP, AND ON THEIR EXCRETION OF SODIUM AND WATER IN URINE AND FAECES

Rangelands Research Unit
CSIRO, Riverina Laboratory
Private Bag, P. O.
Deniliquin, N.S.W. 2710
A. D. Wilson and M. L. Dudzinski
Australian Journal of Agricultural Research, Vol. 24, No. 2, p. 245-256, 1973. 8 fig, 1 tab, 12 ref.

Descriptors: *Sheep, *Saline water, *Farm wastes, Sodium, Water, Urine, Diet, Salts, Potassium, Sodium chloride, Moisture content
Identifiers: *Excretion, *Feces, Food intake, Salt tolerance

Merino sheep were given fixed volumes of fresh and saline drinking water. The volumes varied from 0.5 to 6.0 liter per day, and salt content ranged from 1.5 to 2.0% sodium chloride. The intake of food and the excretion of urine and feces were then recorded. It was found that food intakes increased with an increase in either fresh or saline water. When sodium chloride was added to the water the food intake decreased but was restored by an increase in the volume of water given of C. 50% for 1.5% salt, and C. 100% for 2.0% salt. When sheep were given saline water the sodium content of the urine increased, but the sodium content of the faeces remained the same. The volume of urine excreted was related to the amount of sodium and potassium to be excreted, but the amount of water excreted in the faeces was related to the type of diet and the amount of faecal dry matter excreted. (Russell-East Central)

1539 - A1, B1, D1, E1, F2
SLURRY AND WASTE DISPOSAL
19 The Crescent
Taunton, Somerset
Great Britain
D. Gowan
Suffolk, England, Farming Press Limited, 1972, 244 p, 44 fig, 37 tab, 12 ref.

Descriptors: *Slurries, *Farm wastes, *Waste disposal, *Legal aspects, Soils, Economics, Water pollution, Sampling, Poultry, Lagoons, Hogs, Waste treatment, Aeration, Equipment, Odor, Diseases, Cattle, Waste storage, Fertilizers
Identifiers: *Great Britain, Land disposal, Pollution, Public health

Many problems face farmers today, and this book examines problems in the area of animal and agricultural discharges. There is a technical discussion of the problems of waste disposal, and the special problems of different forms of effluent are discussed. A substantial part of the book deals with the legality of discharges in the area of Statutory Law and Common Law. This British author also discusses poultry, swine, and cattle waste disposal problems. The final sections of the book bring out effects of these discharges on the soil, current research in the area of waste disposal, and prospects concerning the future problems of the agricultural industry in the United Kingdom. The overall view point of the book is that it is time for farmers to get their heads out of the sand and start working to solve these waste disposal problems. (Russell-East Central)

1540 - A2, A4
WATER SOLUBLE ORGANIC SUBSTANCES LEACHABLE FROM FEEDLOT MANURE
U. S. Department of Agriculture
Ft. Collins, Colorado
A. R. Mosier, K. Haider, and F. E. Clark
Journal of Environmental Quality, Vol. 1, No. 3, p. 320-323, July-September, 1972. 3 tab, 17 ref.

Descriptors: *Feedlots, *Farm wastes, *Leachate, *Organic matter, Sampling, Runoff, Soil profile, Groundwater pollution, Phenols, Nitrogen, Wells, *Manure

Little is known about the fate of the water-soluble organic products of animal excretion once they enter the soil. Because of this many water samples were taken from feedlots, shallow wells near feedlots, a local river, and soil from a grassland to see if organic materials were readily dispersed from feedlot surfaces. The organic materials readily move on the ground surface due to runoff, but in soil beneath the feedlot or in soil away from the feedlot only free phenolics were found to have leached. Only trace amounts of low-molecular-weight organics were found in ground water samples. From the results, it was concluded that there is no uniform or continuing movement of organic material from the feedlot surface through the soil profile to the ground water under the sites examined. (Russell-East Central)

1541 - B1, C2, E2, E3
SOLIDS-LIQUID SEPARATION—AN IMPORTANT STEP IN THE RECYCLING OF DAIRY COW WASTES
Department of Agricultural Engineering
Purdue University
Lafayette, Indiana 47807
Journal of Milk & Food Technology, Vol. 36, No.
A. C. Dale
5, p. 289-295, 1973. 2 tab, 15 ref.

Descriptors: *Recycling, *Farm wastes, *Cattle, *Dairy industry, Biochemical oxygen demand, Economics, Waste treatment, Waste disposal, Biodegradation, Drying, Equipment, Composting, Methane, Proteins, Oil
Identifiers: Solids-liquid separation, Refeeding, Land disposal, Building blocks.

For years dairy farmers have looked for a waste management system which would lower labor requirements, make mechanical handling possible, improve automation, lower pollution, and produce something of economic value. Solids-liquid separation may be the answer to the complex and expensive problem of waste disposal. In solids-liquid separation, particles 5/u or larger are removed from the liquid part of the waste. The two fractions left are wet solids and a dilute liquid. The solids contain about 45-80% water. They have little or no odor and may be dried and used for refeeding, mulch, or bedding, thus giving it economic value. The liquid fraction contains about 1-3% suspended solids and about 85-90% of the five-day Biological Oxygen Demand. The liquid can be easily handled by ordinary equipment and can be irrigated directly onto crops and soils, (Russell-East Central)

1542 - A5, B1, C3
DETECTION OF CARBONYL SULFIDE FROM BEEF CATTLE MANURE
U. S. Department of Agriculture
Lincoln, Nebraska
L. F. Elliott, and T. A. Travis
Soil Science Society of America Proceedings, Vol. 37, No. 5, p. 700-702, Sept./Oct., 1973. 1 tab, 5 fig, 8 ref.

Descriptors: *Feed lots, *Cattle, *Odor, *Gases, *Farm wastes, Hydrogen sulfide, Methane, Carbon monoxide
Identifiers: *Odor detection, *Carbonyl sulfide, *Manure

Before odors and gases can be controlled they must be identified and their intensity and quantity must be determined. Basic research was conducted to identify and quantify some of the sulfur compounds and gases emanating from anaerobically incubated cattle manure. One compound identified was carbonyl sulfide. It was found in the headspace above fresh manure, feedlot compost, a debris basin, and soil from a feedlot. Carbonyl sulfide became progressively stronger from day 1 to 5 and then declined. Hydrogen sulfide was similar and persisted for 16 days. Methane was also found and never exceeded 7.5% over fresh manure. In the headspace over compost, methane exceeded 30%, hydrogen sulfide appeared after 5 days, and only traces of carbonyl sulfide appeared. (Russell-East Central)

1543 - A2, B2, E2
PERFORMANCE OF FEEDLOT RUNOFF CONTROL SYSTEMS IN MINNESOTA
Department of Agricultural Engineering, Minnesota University, St. Paul.
C. L. Larson, L. G. James, P. R. Goodrich, and J. A. Bosch.
Presented at the 1974 Annual Meeting, American Society of Agricultural Engineers, Oklahoma State University, Stillwater, June 23-26, 1974. Paper No. 74-4013, 17 p. 3 fig., 4 tab, 9 ref.

Descriptors: *Performance, *Feed lots, *Runoff, *Minnesota, Waste storage, Waste disposal, Irrigation, Precipitation (Atmospheric), Mathematical models, Slopes, Climatic data, Farm wastes,
Identifiers: Runoff control systems, *Holding pond, Land disposal, Formula.
Livestock.

Feedlots located on sites with a considerable slope are potential pollutors from runoff. Runoff is generally controlled by involving a holding pond with land disposal of the stored water. A mathematical model was constructed to determine factors influencing runoff control. Results indicate that in Minnesota, holding pond outflow is caused by a series of rainstorms occurring within a period of five to ten days. This is because disposal of stored runoff is seldom possible during these times. If the holding pond is designed on the one-day rainfall and runoff data, it should be increased by factor C to obtain an overflow frequency. However, if the holding pond is made larger than necessary, the amount of land disposal can be reduced. For efficient operation of a runoff control system, the holding pond capacity should be equal to the sum of three components: the design runoff, the minimum pumpout, and the residual storage. (Russell-East Central).

1544 - A1, F2
SUPREME COURT UPHOLDS JUDGEMENTS IN HBI CASE
L. Harper.
Missouri Ruralist, January 23, 1971, p. 12.

Descriptors: *Air pollution, *Legal aspects, *Odor, *Water pollution, *Confinement pens, Hogs.
Identifiers: *Supreme court, *Judgement, *Plaintiffs.

Reported is the results of a long term legal battle between Hog Buliders, Inc. and Glen and Doris Bower and Frank and Minnie Bower. The suit was filed in 1969 by the Bowers who contended that HBI had been negligent in their pollution control, had devalued the Bowers' land, and had impaired their living. The suit was heard by a jury and the jury found HBI guilty of both actual and punitive damages. The Bowers were awarded $136,200 by the jury. The case was then appealed to the Missouri Supreme Court, but the court held with the jury. HBI awarded the Bowers $136,200 and sold the hogs. The facilities were empty for several months until HBI sold the land. This case has caused many feeders to take extra precautions, and it is hoped that this case does not lead to many more law suits. (Russell-East Central).

1545 - B1, E2, F1
THE PLUS AND MINUS OF CONFINEMENT
Feedlot Management, Vol. 15, No. 13, p. 25-27, 30, 32, 46, December, 1973. 5 fig.

Descriptors: *Confinement pens, *Cattle, *Feed lots, Farm wastes, Waste treatment, Waste disposal, Fertilizers, Performance.
Identifiers: *Confinement buildings, Land spreading, Holding tank, Slotted floors, Open feed lots.

Confinement feeding is currently one of the major methods of maintaining an efficient feedlot operation. One such confinement feeder is Ray Lawson of Maple Park, Illinois. His cold-air confinement building has served for two years and promises to enhance the operation for years to come. The cost of a confinement feedlot operation is about $110 per animal unit. The waste system consists of a holding tank beneath the slotted floor in the confinement facility. The wastes are then spread on land and the value of the feritlizer is estimated at about $35 per acre. Trials conducted on an uninsulated confinement facility and an open lot feedlot have indicated that the performance of feedlot cattle in an uninsulated confinement building is inferior to that of cattle fed in open lots with access to overhead shelter. However, construction of a confinement building can be justified because there is elimination of bedding costs, pollution control, mechanization, the substitution of capital for labor, less land area required, cleanliness of cattle, better control over flies, and the possibility of fewer health problems in a confinement operation as compared to an open feedlot. (Russell-East Central),

1546 - A1, B1, D1, E1, F1, F4

SWINE WASTE MANAGEMENT ALTERNATIVES

L. B. Driggers, J. M. Falter, J. R. Jones, G. J. Kriz, J. F. Lutz, et. al.
Cooperative Extension Work in Agriculture and Home Economics, North Carolina State University, Raleigh and USDA Cooperating. 24 p. 1 fig., 9 tab

Descriptors: *Hogs, *Farm wastes, *Waste treatment, *Waste disposal, *Waste storage, Lagoons, Drying, Odor, Pest control, Economics, Soils, Nutrients, Rates of application, Crops, Effluent, Storage tanks, Chemical properties, Physical properties, Leaching, Runoff, Slurries, Costs.
Identifiers: *Swine, *Waste management, Land spreading, Composting, Mechanical aeration, Flies.

Swine production is becoming a more specialized and complex operation. This bulletin is designed to help swine producers meet problems in the most practical and economical way. Alternative waste management systems, utilization and land requirements, odor control, pest control, and economics are discussed. The section on utilization and land requirements presents guidelines and examples of the amount of waste that can be applied per acre. The sections on odor and pest control provide suggestions and methods for reducing odor and pest problems. The section on economics gives estimated cost data and contains a partial budget sheet so that comparisons between the alternative waste management systems can easily be made. No matter what means of waste management system is chosen, good management is necessary to maintain an effective operation. (Russell-East Central).

1547 - A5, B2

IDENTIFYING ODOROUS COMPONENTS OF STORED DAIRY MANURE

Department of Agricultural Engineering, Clemson University, Clemson, South Carolina.
C. L. Barth, and L. B. Polkowski.
Presented at 1971 Winter Meeting, American Society of Agricultural Engineers, Chicago, Illinois, December 7-10, 1971, Paper No. 71-568, 27 p., 6 fig.

Descriptors: *Odor, *Farm wastes, *Waste storage, *Dairy industry, Cattle, Liquid wastes, Sampling, Sludge, Ammonia, Chromatography.
Identifiers: *Manure, *Selective absorption, *Steam distillation, *Paper chromatography, *Odorants, Identification, Supernatant.

The biggest problem that livestock producers face is odor management. Livestock producers generally either try to eliminate the initial production of the odorous components or control the odorous material after it is produced. Before effective odor control can be achieved the odorous compounds must be identified. Processes used in this experiment designed to identify odorous compounds were selective absorption, steam distillation, and paper chromatopgraphy. Selective absorption separated volatile organic acids, amines, ammonia, hydrogen sulfide, mercaptans, and disulfides for further identification. Steam distillation distinguished ammonia and total volatile organic acids. Paper chromatography proved to be a practical tool in identification of odorous compounds. The odorous compounds identified were: acetic, propionic, butyric, and valeric acids; methyl-, dimethyl-, ethyl-, and diethylamine; ammonia, hydrogen sulfide, mercaptans, and disulfides. (Russell-East Central).

1548 - A4, B1, E2

MANURE APPLICATION GUIDELINES FOR THE PACIFIC NORTHWEST

Agricultural Engineering Department, Oregon State University, Corvallis.
T. L. Willrich, D. O. Turner, and V. V. Volk.
Presented at the 1974 Annual Meeting, American Society of Agricultural Engineers, Oklahoma State University, Stillwater, June 23-26, 1974, Paper No. 74-4061, 12 p., 5 tab, 2 ref.

Descriptors: *Pacific Northwest U. S., *Farm wastes, *Waste disposal, *Equations, Nitrates, Fertilizers, Nitrogen, Leaching, Livestock, Waste storage, Lagoons, Irrigation, Volatility.
Idenitfiers: *Manure, *Application rates, *Land spreading.

Most farmers who apply manure to land know very little about how much to apply. Research must supply the answers before ground water supplies are polluted. Generally nitrogen is the limiting factor in manure application because it readily moves in the soil whereas phosphorous and potassium are more static. Accurate rational equations must be developed to estimate: (1) the amount of nitrogen which should be added to the soil to maximize crop yields and to satisfy the normal losses of nitrogen from the soil and the losses that occur when manure nitrogen is substituted for synthetic nitrogen, and (2) the amount of residual manure nitrogen which remains for soil incorporation after the subtracting all losses which occur before soil incorporation. Equations are presented, but future modifications and refinements are essential to correct weaknesses and errors which currently exist. (Russell-East Central).

1549 - E3, F2

RECYCLING ANIMAL WASTES. 1. THE PROBLEMS OF DISPOSAL AND REGULATORY ASPECTS OF RECYCLED MANURES

Nutrition Section, Agricultural Research Council, Poultry Research Center, West Mains Road, Edinburgh EH9 3JS, Scotland.
R. Blair, and D. Knight.
Feedstuffs, Vol. 45, p. 32, 34, March, 1973. 3 tab.

Descriptors: *Recycling, *Farm wastes, *Waste disposal, *Legal aspects, Drying, Odor, Microorganisms, Moisture, Nitrogen, Feeds, Sampling, Diseases.
Identifiers: Animal wastes, *Great Britain, *Manure, Pollution, Refeeding, Feed additives, Drugs.

Since feeding operations are becoming more intensified there is no longer enough land on which to spread manure. Recycling or feeding of manure to farm animals is one possible means of disposing this by-product of modern day feeding. This paper reports on preparation of manure for feeding and on the regulatory aspects of recycling. Probably the most important aspect of preparing manure is drying it. For commercial purposes, Quality Control Standards suggest that poultry manure should have less than 15% moisture, not less than 5% nitrogen, and good appearance with little odor. If it is being incorporated into feed, it should list any drugs or additives and good hygiene should be practiced. Regulations look unfavorably on recycling manure because it may contain drugs, antibiotics, or disease organisms. However, when dried poultry manure has been properly processed, it appears to present no serious health dangers when fed to ruminants. Further research is necessary before the Food and Drug Administration will approve use of manure in feeds. (Russell-East Central).

1550 - C4

A QUANTITATIVE COMPARISON OF THE FAECAL MICROFLORA OF BABOONS FED A NATURAL DIET OR A SYNTHETIC DIET COMPLETE OR DEFICIENT IN PYRIDOXINE OR RIBOFLAVIN

Wellcome Trust Research Laboratories, P.O. Box 43640, Nairobie, Kenya.
P. F. Uphill.
The Journal of Applied Bacteriology, Vol. 36, No. 3, p. 501-511, September, 1973. 2 tab, 42 ref.

Descriptors: *Diets, *Microorganisms, Sampling.
Identifiers: *Animal wastes, *Baboons, Faecal microflora, Pyridoxine, Riboflavin

A group of baboons were fed a natural diet of fruit and vegetables while three other groups of baboons were fed a synthetic diet which either included pyridoxine and riboflavin or was deficient in both. Quantitative analysis was then made of the baboon faecal material to study its microflora. There appeared to be no significant difference in the microbial counts of baboons fed diets deficient in pyridoxine and riboflavin and baboons on natural diets. The groups fed the synthetic diet had increases in Clostridium weichii and lactose-fermenting enterobacteria with a decrease in lactobacilli. There was a slight reduction of yeasts and a slight increase of microcococci, staphylococci, and faecal strepococci. When the groups were first fed the synthetic diet there was a marked change in microflora which was very stable. When the groups were then fed a natural diet, another marked change in microflora occurred. (Russell-East Central).

1551 - A2, B1

PROJECTS OF THE AGRICULTURAL AND MARINE POLLUTION CONTROL SECTION

Applied Science and Technology Branch, Office of Research and Monitoring, Environmental Protection Agency, Washington, D. C. 20460.
K. Jacobson and W. J. Lacy.
Environmental Protection Agency Research Report EPA-R2-73-171, March, 1973, 201 p.

Descriptors: *Agriculture, *Projects, *Farm wastes, *Research and development, Forestry, Agricultural runoff, Feed lots, Recreation, Oil spills.
Identifiers: *Marine pollution, Logging, Irrigation return flow, Watercraft wastes, Hazardous material spills.

Projects of the Agricultural and Marine Pollution Control Program—March 1973 is a compilation of the information sheets of the 160 projects initiated from fiscal year 1972. Each sheet contains the objectives, statistical information and a brief description of an initiated project. General introductory information on the Environmental Protection Agency's Agricultural and Marine Pollution Control Program is also presented to provide perspective on the magnitude of these non-point pollution problems and the research direction that must be pursued in order to develop the technology to adequately control non-point sources in the United States. (Jakobson and Lacy-EPA).

1552 - A1, B1, F2

PHILOSOPHY ON LIVESTOCK WASTE REGULATION

Missouri University, Columbia.
D. R. Levi.
Presented at 1971 Winter Meeting of the American Society of Agricultural Engineers, Chicago, Illinois, December 7-10, 1971, Paper No. 71-918, 10 p.

Descriptors: *Farm wastes, *Livestock, *Regulation, *Legal aspects, Feed lots, Agriculture, Biochemical oxygen demand, Effluent, Water pollution, Odor, Zoning, Waste treatment, Damages.
Identifiers: Manure, Nuisance, Site selection.

There are two types of regulations under which a livestock farmer can be prosecuted or fined for environmental damage. The first are public regulations, such as the States and Federal Government have promulgated in the Water Quality Act of 1965 and comparable State bills. These laws usually provide objective criteria for matter discharged into water or air, for example, maximal BOD levels for effluents discharged into streams. Private regulation usually takes the form of nuisance laws, where the more objective human tolerance for noise, odor, or water pollution is given a legal form. A farmer who endangers his neighbors' health, well-being, or livelihood by polluting their water supplies, or making their air foul-smelling is subject to damage suits, injunctions, fines, or a combination of these. Zoning helps to minimize suits since it insures that the land use is not unreasonable in itself. However, a farmer in a zoned agricultural area may still produce a nuisance and be taken to court. Selecting a site for livestock pens as far as possible from homes and complying with all existing State laws and codes can not only abate the pollution generated by a farm creating a hazard but indeed has done what the law requires. Waste treatment facilities are the single best insurance against legal action, and farmers and agricultural engineers should cooperate to draft realistic and practical laws in agricultural waste control. (Solid Waste Information Retrieval System).

1553 - D1, E2, E3

BIODEGRADATION OF ANIMAL WASTE BY LUMBRICUS TERRESTRIS

University of Georgia College of Agriculture Experiment Stations, College Station, Athens.
O. T. Fosgate, and M. R. Babb.
Journal of Dairy Science, Vol. 55, No. 6, p. 870-872, 1972. 1 tab, 4 ref.

Descriptors: *Farm wastes, *Recycling, *Waste treatment, Biodegradation, Lime, Proteins, Cattle, Dairy industry.
Identifiers: *Earthworms, *Lumbricus terrestris, *Potting soils, Cats, Dead animal disposal.

Earthworms on a diet of raw dairy cattle feces and water with sufficient lime added to maintain a pH of 7.0 produced 1 kg of worms for each 2 kg of dry fecal matter. The earthworm castings, a loose friable humus type of soil containing three per cent nitrogen, provide an excellent greenhouse potting soil weighing half as much as the usual potting soil and providing more flowers on more strongly rooted plants. The earthworm meal, containing 58 per cent protein and 2.8 per cent fat, is very palatable to domestic cats. (Whetsone, Parker, and Wells-Texas Tech).

1554 -D4

TECHNIQUES FOR THE ENUMERATION OF ANAEROBIC MICROBES IN WASTE FERMENTATION SYSTEMS

Department of Agricultural Engineering, University of Kentucky, Lexington.
H. E. Hamiltin, I. J. Ross, and S. W. Jackson.
Presented at 1971 Winter Meeting of the American Society of Agricultural Engineers, Chicago, Illinois, December 7-10, 1971, Paper No. 71-570, 19 p., 9 fig., 4 ref.

Descriptors: *Farm wastes, *Anaerobic bacteria, *Fermentation, *Waste treatment, *Analysis, Equipment, Design, Livestock, Diseases, Poultry, Sampling.
Identifiers: *Microbes, *Plating, Manure, Rumen.

Although procedures for plating and counting microbes, in aerobic and anaerobic conditions, are well established, they are, especially under anaerobic conditions, extremely time-consuming and difficult. Special equipment is needed, particularly when large quantities of materials are to be analyzed. Autoclaved poultry manure was fermented with rumen microbes in this study; new equipment and procedures were designed for this purpose. A rumen sampling device, consisting of a stainless steel wire mesh cyclinder covered with two layers of cheesecloth and attached to a stainless steel tube, served as a probe and filter. This permitted rumen to be removed from a fistulated steer under anaerobic conditions. A special dispensing needle made possible the preparation of culture tubes at a rate of about 175 per hour. By placing a rack with a series of manifolds under a plastic hood, a number of test tubes could be inoculated rapidly. Colony counting equipment reduced the time needed to mark tubes and count colonies. (Solid Waste Information Retrieval System).

1555 - A2, C4, E3

ENTEROBACTERIA IN FEEDLOT WASTE AND RUNOFF

Northern Regional Research Laboratory, Northern Marketing and Nutrition Research Division, Agricultural Research Service, U. S. Department of Agriculture, Peoria, Illinois.
G. I. Hrubant, R. V. Daugherty, and R. A. Rhodes.
Applied Microbiology, Vol. 24, No. 3, p. 378-383, September, 1972. 6 tab, 12 ref.

Descriptors: *Feed lots, *Farm wastes, *Runoff, Waste disposal, Recycling, Sampling, Microorganisms, Cattle.
Idenitifiers: *Enterobacteria, Manure, Refeeding, Health hazards.

Refeeding of wastes is currently being investigated as a possible means of combating vast accumulations of waste from animal production. However, little attention has been given to the possible microbiological aspects of feedlot waste. This study was done to determine the types of microflora found in feedlot waste and associated sites. Samples were taken from feedlot waste, runoff from the pens, and water from a large drainage ditch at the feedlot, and they were examined for **Enterobacteriaceae.** Five-hundred and fifty-three cultures were isolated in all. Feedlot waste contains about 50,000,000 enterobacteria per gram. More than 90% of these were **Escherichia coli.** Enrichment techniques allowed isolation of four **Proteus** spp., both **Providencia** spp., **Klebsiella, Enterobacter aerogenes, Arizona,** and single isolate of **Salmonella.** Neither **Arizona** nor **Salmonella** were isolated from the drainage ditch or runoff. Results indicate that the refeeding of unsterilized feedlot waste is potentially hazardous due to the wide spectrum of enterobacteria found in these wastes. (Russell-East Central).

1556 - A1, E2

RELATIVE LEACHING POTENTIALS ESTIMATED FROM HYDROLOGIC SOIL GROUPS

U. S. Department of Agriculture, Hydrograph Laboratory, Beltsville, Maryland 20705.
G. B. England.
Water Resources Bulletin, Vol. 9, No. 3, p. 590-597, June, 1973. 2 fig., 2 tab, 7 ref.

Descriptors: *Leaching, *Groundwater pollution, Soils, Percolation, Soil profiles, Agricultural chemicals, Water pollution, Runoff, Rates of application, Fertilizers, Nitrates.
Identifiers: *Hydrogen soil groups.

The problem of pollution has caused many questions to be asked concerning additives to the soil. It is very hard to determine the effects of leaching with respect to chemicals on or in the soil. Leaching with water can be both hazardous and beneficial. But it always can be considered potentially hazardous if leaching occurs on soils whose applied agricultural chemicals are improperly planned. One reason for the difficulty of determining the effects of leaching is the difficulty in determining soil permeability. Curves used by the Soil Conservation Service in flood control planning offer a reliable estimate of the amount of water expected to infiltrate the soil and take subsurface paths. Rates on which the Soil Conservation Service Hydrologic Soil Groups are based give the best estimate of the rate of flow through saturated profiles. This information should help in planning applications with minimum loss. (Russell-East Central).

1557 - A1

MOVEMENT OF NITRATES UNDER IRRIGATED AGRICULTURE

College of Engineering and Architecture, Nebraska University, Lincoln.
D. M. Edwards, P. E. Fischbach, and L. L. Young.
Transactions of the ASAE, Vol. 15, No. 1, p. 73-75, 1972. 6 fig., 14 ref.

Descriptors: *Nitrates, *Irrigation, *Groundwater pollution, *Soil contamination, Fertilizers, Nitrogen, Soil profiles, Runoff.

This study was undertaken to determine the movement of nitrate nitrogen under irrigated agriculture. It was designed to help shed some light on the growing problem of nitrate pollution of soil and groundwater. Laboratory and field studies were undertaken with nitrates being added to the subsurface of the soil. Results indicate that with a properly designed irrigation system, little or no nitrate movement should occur outside the root zone. Field studies also indicate that a runoff water re-use system is necessary to prevent pollution of surface waters if irrigation is occurring on fields to which nitrogen fertilizer has been added. Other conclusions are that once nitrates enter the soil surface they do not re-enter the runoff water, except possibly through erosion. Also nitrates were found to move with the wetting front when the soil is dry, but they do not if the soil is initially saturated. (Russell-East Central).

1558 - A2, D4

LABORATORY STUDIES ON FEEDLOT RUNOFF

Department of Civil Engineering, Nebraska University, Lincoln.
T. J. McGhee, L. R. Christenson, and W. R. Bonneau.
Journal of Environmental Engineering Division, ASCE, Vol. 99, No. EE6, p. 883-896, December, 1973, Proceedings Paper 10205. 8 fig., 5 tab, 16 ref.

Descriptors: :Feed lots, *Agricultural runoff, *Farm wastes, *Waste treatment, Sedimentation, Retention, Biochemical oxygen demand, Aeration, Activated sludge, Adsorption.
Identifiers: Color removal.

A field unit at the University of Nebraska revealed that effective treatment of settled feedlot runoff may be obtained at liquid retention times of 2 days with a positive solids return activated sludge system. The oxygen demand of feedlot runoff is not measured adequately by the 5 day biochemical oxygen demand determination but may be approximated from the chemical oxygen demand determination. The oxygen uptake of feedlot runoff as measured in the Warburg apparatus is a power function of time for at least 90 days. Removal of color is possible by adsorption on both activated carbon and clayey fine sand. Pretreatment is important since the adsorptive capacity of any such medium is limited. (Cartmell-East Central).

1559 - B3, D1, E3

SYNTHESIS GAS FROM MANURE

Department of Chemical Engineering, Texas Tech University, Lubbock.
K. L. Herzog, H. W. Parker, J. E. Halligan.
Presented at the 73rd National Meeting of the American Institute of Chemical Engineers, Detroit, Michigan, June 3-6, 1973, 17 p., 5 fig., 3 tab, 7 ref.

Descriptors: *Gases, *Farm wastes, *Recycling, *Synthesis, Cattle, Feed lots, Oxidation, Hydrogen, Ammonia, Methane.
Identifiers: *Manure.

With ammonia synthesis gas the objective, bench-scale studies of the partial combustion of cattle manure have been made. Results for continuous partial oxidation of −40 +60 sieve manure particles at feed rates up to 0.17 lb/hr in a 1.6 inch I.D. fluidized bed reactor are presented. The effect of increased reaction temperature, which was studied from 1285 to 1432 degrees, was to more than double ultimate H_2 yields from 8.5 to 18.5 SCF/lb dry, ash-free manure. These ultimate yields of hydrogen, which include projected conversions of the experimental yields of hydrocarbon gases, show that, given manure from 600,000 feedlot cattle, ammonia production of up to 920 tons/day can be achieved. (Herzog, Parker, Halligan-Texas Tech).

ABSTRACTS

1560 - A9, A10, C1

ANALYZING BIOLOGICAL PROPERTIES OF WASTES

Department of Microbiology, Colorado State University, Fort Collins.
S. M. Morrison, and K. L. Martin.
Preprint copy, 12 p., 27 def.

Descriptors: *Analysis, *Farm wastes, *Tests, Pathogenic bacteria, Air pollution, Water pollution, Bacteria, Coliforms, Sampling, Microorganisms, Ecology.
Identifiers: *Biological properties, Quantitative measurements, Fecal coliforms, Fecal streptococci, Total plate count, Pollution.

Because of the growing concern in the control of pollution and environmental hazards it is imperative that some sort of standardization of tests be developed in the field of waste analysis. Many of the problems encountered in the analysis of animal wastes are caused by the variability of the crude product. Measurements or analyses of domestic animal wastes fall into three main categories: (1) standardized tests that have gained professional, governmental, and judicial status; (2) tests which detect disease-causing organisms; and (3) tests for organisms that cause pollution to the environment and are involved in the aesthetic quality of agricultural businesses. The basic standardized tests are for total coliforms, fecal coliforms, enterococci or fecal streptococci, and total plate counts. In the detection of pathogenic organisms there are standardized tests for a broad array of organisms. In the tests for organisms that cause pollution, variables such as temperature, pH, salts, nutrients, oxygen, moisture, nitrogen compounds, and minerals should be taken into account because they affect the growth of organisms. (Russell-East Central).

1561 - A1, E2

EFFECTS OF CATTLE FEEDLOT MANURE ON CROP YIELDS AND SOIL CONDITIONS

USDA Southwestern Great Plains Research Center, Bushland, Texas.
A. C. Mathers, B. A. Stewart, J. D. Thomas, B. J. Blair.
Research Center Technical Report Number 11, Texas Agricultural Experiment Station, Texas A&M University, December, 1972, 13 p., 6 fig., 1 tab.

Descriptors: *Farm wastes, *Feed lots, *Cattle, *Crops, *Waste disposal, Nitrates, Salts, Analysis, Irrigation, Soils, Physical properties, Chemical properties, Rates of application.
Identifiers: *Yields, *Soil conditions, *Land spreading, Saturated paste extracts, Plowing depths.

Data suggests that manure applications of 10 tons per acre furnish adequate nitrogen for most crops without high salt buildup in the soil. Also applications of 10 tons per acre do not effect organic levels of the soil. Higher rates of manure can be added to soil without lowering yields of the soil. Deeper plowing depths usually alleviate this problem. Conclusions of manure application suggest that at just 10 tons per acre, land area in even the most concentrated feeding areas is adequate to dispose of the manure. In fact only about one-fourth of the cropland in Texas used for grain sorghum alone would have to be treated to dispose of the manure. The challenge is to develop distributing and handling systems to spread the manure on croplands most beneficially. (Russell-East Central).

1562 - B3, E3

REFEEDING FEED

G. Sollenberger.
The Furrow, Vol. 79, p. 12-13, April, 1974. 3 fig.

Descriptors: *Recycling, *Farm wastes, *Feeds, *Cattle, Feed lots, Poultry, Waste disposal, Oxidation ditch, Waste treatment, Silage, Proteins, Solid wastes.
Identifiers: *Refeeding.

Due to the increase in confinement livestock production, a growing effort is making manure feeding a more systematic practice. Large-scale recycling of manure for feed might solve some of the waste-disposal and pollution problems that confinement operations often create. Analyses show that livestock wastes contain 12 to 40% protein and 40 to 70% carbohydrates and are produced at an annual rate of from 1.5 to 2 billion tons. Experiments with recycling raw manure from feedlot cattle as feed have had promising results. Poultry waste and straight litter also show promise as a ration ingredient. An alternative to feeding waste itself is using it as nutrition for various organisms that can then be fed to cattle. However, before a large scale commercial recycling program can begin, many more tests must be conducted to examine the economics, nutrition, and safety of recycling wastes. But, the concensus seems to be that whatever the problems, they can be overcome, and there is no reason to doubt that animal wastes will be a great asset in the future production of meat protein. (Russell-East Central).

1563 - B3, E3

RECYCLING DPW FOR GREATER RETURN

Texas A&M University.
J. R. Couch.
Poultry Digest, Supplement, Vol. 33, No. 384, P. A-1-A-7. 4 fig.

Descriptors: *Recycling, *Feeds, *Poultry, Ruminants, Protein, Nitrogen, Phosphorous, Farm wastes, Waste treatment, Waste disposal, Nutrients.
Identifiers: *DPW, *Dried Poultry Waste, Laying hens, Uric acid, Chicks, Manure, Turkeys.

Dehydrated poultry manure contains about 10% true protein which may contribute significant amounts of essential amino acids and phosphorous in formulated feeds. Growing chicks can tolerate up to 5% DPW without adverse effects. DPW can compose up to 25% of the total ration of laying hens. It has been estimated that the nutrient utilization of the essential nutrients found in DPW will be 30-35%. From the data reported, it is apparent that it is not possible to recycle more than about 25% of the total manure produced by laying hens. This leaves 75% of the fecal material to be disposed of through other waste management procedures. It has also been found that ruminants can efficiently utilize both the true protein and the nitrogen originating from uric acid. Satisfactory performance has been obtained from feeding poultry waste levels up to 50% of the total ration. The use of poultry wastes in cattle feeds would appear to be much more desirable than the use in poultry feeds. (Russell-East Central).

1564 - C2, C3, D1, E3

SHORT-TIME, HIGH-TEMPERATURE EXTRUSION OF CHICKEN EXCRETA

Agricultural Engineering Department, Kentucky University, Lexington.
F. A. Payne, I. J. Ross, H. E. Hamilton, and J. D. Fox.
Transactions of the ASAE, Vol. 16, No. 4, p. 750-754, July-August, 1973. 6 fig., 17 ref,

Descriptors: *Poultry, *Temperature, *Farm wastes, Heat, Moisture content.
Identifiers: *Extrusion, *Chicken exrcreta, Sterilization, Chemical analysis, Uric acid, Microbial analysis,

A study was done to determine the feasibility of applying an extrusion cooking process for the sterilization of chicken excreta and a chicken excreta-feed mixture and to determine some of the chemical and physical changes in the materials resulting from this process. This short-time, high-temperature process has versatility, a high productivity, low cost, and offers the ability to control the time-temperature relationship. An experimental extruder consisting of a plunger, barrel and an electrically heated die was constructed for the tests. The sterilization parameters were found to be in the range of those commonly used in food processing, but the test design was not sufficient to prove the theoretical development. However, based on the microbial parameters estimated, an extruder could be used to sterilize chicken manure. The extrudate was analyzed for changes in uric acid, ether extract and total nitrogen. The only significant change found was the decrease in ether extract of the chicken excreta-feed mixture with increasing extrusion temperature. Loss of moisture associated with flash volatilization and evaporative cooling was determined. (Cameron-East Central).

1565 - A4, B1

DAIRY WASTE MANAGEMENT

Albert A. Webb Associates.
Albert A. Webb Associates, Consulting Engineers, Riverside, California, March, 1974, 177 p., 34 fig., 36 tab, 44 ref.

Descriptors: *Dairy industry, *Farm wastes, *Management, *California, *Water quality, *Water pollution, *Waste disposal, *Watersheds, Bacteria, Runoff, Salts, Leaching, Recycling, Equipment, Economics, Costs, Air pollution.
Identifiers: *Santa Ana River Basin, Composting, Sanitary landfill.

One of the most producitve regions in Southern California is the Santa Ana River Basin. However, over the years the water quality and quantity have been difficult to maintain. Recognizing the problem, a cooperative effort which will supply water users a continuous supply of good quality water was undertaken. Some of the major problems faced in the Santa Ana Watershed are: (1) salt imbalances which threaten ground water supplies; (2) excess nitrates in the domestic water supplies; and (3) bacterial and viral contamination of surface waters. This study was designed to determine economically feasible methods by which the dairy industry could reduce the amount of salts added to the ground water of the basin to 0.3 ton per acre per year. This study involves a survey of the problems in the valley with: an evaluation of the waste streams from individual cows to the dairy; methods of collecting, treating, and disposing of these waste streams; the economic and organizational aspects of doing this; and recommendations of a plan to achieve the objective. (Russell-East Central).

1566 - B3, E3

CORN, MANURE AND SILAGE MAKE AN EXOTIC RATION

Successful Farming, Vol, 72, No. 5, p. B10-B11, March, 1974. 5 fig.

Descriptors: *Silage, *Feeds, *Recycling, *Farm wastes, *Feed lots, *Cattle, Performance, Costs, Management.
Identifiers: *Corn, *Manure, *Refeeding.

The key to making refeeding animal wastes practical is to mechanize handling and to develop proper management of the unusual feed. A Georgia feedlot owner feeds a mixture of 45% cracked shelled corn, 15% corn silage and 40% manure to his cattle. The ingredients are mixed in a large mixer wagon and blown into a sealed silo. After fermenting, the sweet smelling feed makes a 12% protein ration that includes 70% total digestible nutrients. The mixture is cheap and efficient and handling is easy. Rate of gain is nearly a quarter of a pound more per day than on a normal ration (80% shelled corn, 7% hay and 12% protein supplement). The Federal Drug Administration allows farmers and feedlot operators to recycle waste from their own operation. (Cartmell-East Central).

1567 - B2, E3

SOLID SUBSTRATE FERMENTATION OF FEEDLOT WASTE COMBINED WITH FEED GAINS

Agricultural Research Service, U. S. Department of Agriculture, Northern Regional Research Laboratory, Peoria, Illinois.
R. A. Rhodes, and W. L. Orton.
Presented at the 67th Annual Meeting of American Society of Agricultural Engineers, Oklahoma State University, Stillwater, June 23-26, 1974, Paper No. 84-3032, 18 p., 5 fig., 4 tab, 10 ref.

Descriptors: *Farm wastes, *Feed lots, *Waste treatment, *Fermentation, *Feeds, *Proteins, *Recycling, Odor, Liquid wastes, Nitrogen, Incubation, Aerobic conditions, Bacteria.
Identifiers: *Grains, *Refeeding, *Solid substrate fermentation.

Manure is recognized as being a potential nutrient source for feed, and generally the manure is fed directly as a nitrogen source. But a new and different process is being developed involving ensilage of the liquid fraction of feedlot waste and cracked grains. This process is called solid-state fermentation. The liquid contains 10% solids in the form of microbial cells and fine waste components. When added to cracked grain such as corn the thick liquid adheres to grain surfaces. The grain-waste mixture is incubated by tumbling slowly in a revolving vessel and rapidly undergoes acid fermentation caused by the growth of lactic acid bacteria. Yeasts emerge after incubation, and the bacteria cells grow rapidly. The odor quickly disappears as 0.1 meq of acid per gram is generated, but the nitrogen is conserved. Lactic, acetic, proprionic, and butryic acids are formed in the process. The fermented product has 18% more protein than the unfermented grain. This process shows positive results for the generation of higher protein content grain-based rations. (Russell-East Central.

1568 - A1

NONPOINT AGRICULTURAL POLLUTION: STATUS OF ASSESSMENT METHODOLOGY

Midwest Research Institute, Kansas City, Mo.
A. Aleti, S. Y. Chiu, and A. D. McElroy.
Presented at the 67th Annual Meeting of American Society of Agricultural Engineers, Oklahoma State University, Stillwater, June 23-26, 1974, Paper No, 74-4025, 16 p., 2 fig., 2 tab, 27 ref.

Descriptors: *Agriculture, *Water pollution, *Model studies, Nutrients, Microorganisms, Pesticides, Salts, Runoff, Pollutants.
Identifiers: *Nonpoint pollution, Prediction, Sediment.

Agriculture is a major contributor to nonpoint pollution. Agriculture pollutes water quality with such substances as sediments, salts, nutrients, pesticides, biodegradable organics, and microbial populations. These pollutants are the results of natural factors and source practices. The present difficulty with nonpoint pollution control is the inability to assess, in quantitative terms, the effect of control measures. The overall need is to develop comprehensive models which include all pollutants, which are sensitive to the causes of these pollutants, and which recognize interdependencies between pollutants in order to facilitate development of simplified control measures. Some of the needs basic to the construction of these models are: data gaps; analyses of transport phenomena; evaluation of current and past case studies; model-orientated case studies conducted on a wide scope; collection and storage of information; and, systematic analysis of large volumes of data. (Russell-East Central).

1569 - D3, E3

CRUDE OIL FROM MANURE

C. Gross.
Calf News, Vol. 9, p. 3, October, 1971.

Descriptors: *Farm wastes, *Oil, *Organic wastes, *Feed lots, *Recycling, Cattle.
Identifiers: *Manure.

Dr. G. Alex Mills, Chief of the U. S. Bureau of Mines Energy Research Center in Pittsburgh, has perfected a pilot project in which organic waste and carbon monoxide are subjected to 1200 psi pressure at a temperature of 720°F. "Voila! You've got crude oil!" Two tons of manure yield a ton of oil with a BTU content of 14,000-16,000 per lb., and a ton of water. The low-sulphur oil is excellent for power plants. The nation's total annual manure supply would provide about one-half the nation's annual oil requirements. (Whetsone, Parker, Wells-Texas Tech University).

1570 - A1, B1, E1, E2

STREAM POLLUTION FROM ANIMAL PRODUCTION UNITS

Agricultural Engineering Department, Louisiana Technical University, Ruston.
J. W. D. Robbins, D. H. Howells, and G. J. Kriz.
Journal Water Pollution Control Federation, Vol. 44, No, 8, p. 1536-1544, August, 1972.

Descriptors: *Water pollution, *Streams, *Feed lots, Lagoons, Anaerobic conditions, Agricultural runoff, Waste storage, Design, Rainfall, North Carolina, Sampling, Waste disposal, Livestock, Hogs, Chemical analysis, Nutrients, Discharge measurement, Design criteria.
Identifiers: Land spreading, Plowing.

This report summarizes a 2-year study of actual and potential pollution from animal production facilities. The investigation included: assessment of present animal waste management practices; measurement of pollutants reaching streams from 12 typical agricultural sites in North Carlina; development of predictive relationships to estimate the pollution potential of similar animal production units; development of recommendations for corrective action; and identification of researchable problem areas. The following conclusions were made. Anaerobic lagoons as the sole means for animal waste treatment is an unsatisfactory practice in areas where rainfall exceeds evaporation. Although the amount of surface discharge and resulting stream pollution from lagoons can be lessened by reducing the amount of wash water, diverting runoff and locating lagoons to prevent subsurface inflow, at least intermittent subsurface discharge occurs unless deep seepage is excessive. Research is needed to develop reliable design standards for storage lagoons with economical secondary treatment units. The practice of dumping fresh animal wastes directly into streams causes excessive pollution and should be prohibited. The natural pollution load on streams draining agricultural basins devoid of farm animals can be appreciable under certain rainfall conditions and should be taken into consideration in water quality management. Land spreading of manure is a very effective means of minimizing water pollution. (Solid Waste Information Retrieval System).

1571 - E3

ENERGY POTENTIAL FROM ORGANIC WASTES: A REVIEW OF THE QUANTITITES AND SOURCES

Utah University.
L. L. Anderson.
U. S. Bureau of Mines. Information Circular 8549, 1972, 16 p., 3 fig., 3 tab, 26 ref.

Descriptors: *Organic wastes, *Energy, *Farm wastes, *Fuels, *Waste treatment, *Waste disposal, Oil, Gases, Sewage, Industrial wastes, Cattle, Feed lots, Livestock, Recycling.
Identifiers: *Quantities, *Sources, Refuse, Manure, Crop wastes, Conversion, Logging residues.

Enormous quantities of organic wastes are produced each year in the United States. The total amount is in excess of 2 billion tons and at least 880 million tons of this is moisture-and ash-free organic material (dry organic solids), representing a potential energy source of significant magnitude that is not being utilized. Bureau of Mines scientists have developed methods for converting these wastes to convenient energy forms. This report itemizes and evaluates for the first time in detail the quantities and sources of moisture-and ash-free organic material contained in manure, urban refuse, industrial wastes, sewage solids, and agricultural wastes in the United States. Furthermore, estimates are presented for amounts of organic wastes collected or concentrated. The potential for fuel, either oil or gas, from both the total organic wastes generated and those collected or concentrated is also estimated. (Anderson-Utah

1572 - B1, D1, E3

NEW AEROBIC PROCESS TURNS WASTE TO NUTRIENTS

AgChem and Commercial Fertilizer, Vol. 27-28, No. 12-1, p. 24-27, December 1972-January, 1973. 7 fig.

Descriptors: *Farm wastes, *Nutrients, *Fertilizers, Feed lots, Cattle, Water, Feeds, Urine.
Identifiers: *Aerobic process, Manure, Digestor.

The first animal-waste, large scale sterilized organic fertilizer capability is being devoleped by the operator's of Ohio Feed Lot—the world's largest pollution-free enclosed cattle feedlot. Cattle manure is collected by front-loading tractors, dumped into large fan ventilated vats and fed to an aerating digestor. Once the manure is sterilized it is then bagged and packaged in 5, 10, 25, and 50 pound bags of organic fertilizer and sold. Great pains have been taken to make this feedlot operation as self sufficient and environmentally ameliorating as possible, Utilization of natural air flow (aided by fans), the creation of an impermeable feedlot surface, and the development of a guarded cattle diet using the feedlot's own corn-based feed all contribute to the creation of the completely self sustaining and ecology-proof environment that Ohio Feedlot founder W. C. Hackett hopes to develop. (Drewry-East Central).

1573 - A6, B1

GASES AND ODORS IN CONFINEMENT SWINE BUILDINGS

Department of Agricultural Engineering, Illinois University, Urbana.
D. L. Day, E. L. Hansen, and S. Anderson.
Transactions of ASAE, Vol. 8, No. 1, p. 118-121, 1965. 117 fig., 7 tab, 11 ref.

Descriptors: *Gases, *Odor, *Confinement pens, *Hogs, *Farm wastes, Slabs, Ammonia, Carbon dioxide, Hydrogen sulfide, Methane, Waste storage.
Identifiers: *Confinement buildings, *Swine, *Manure, Slotted floors.

The objective of this investigation was to qualitatively analyze the gases and odors produced in confinement swine-finishing building, with and without fluid manure waste handling. A cold trap gas collector was used in an attempt to concentrate condensable gases from the building atmosphere. Ammonia was found in the solid-floor building that was cleaned daily by scraping. The odors in this building, which were very strong and offensive, were collected on a special glass-fiber paper along with feed and dust particles in the atmosphere. Gases detected in the totally slotted-floor building with underfloor pits were carbon dioxide, hydrogen sulfide, methane, and possibly ammonia. They were evidently produced by the biological activity in the ponded wastes. Thus far, there have been no conclusive tests of detrimental effects of the gases and odors on the pigs. However, there have been numerous reports of an unexplained decrease in the rate of gain at about 150 lb. in weight when pigs were raised in confinement buildings with underfloor ponded wastes held in the building for a month or longer. The cold trap, as operated, was not effective in concentrating contaminant gases in the condensate to the extent that they could be analyzed with infrared spectroscopy. (Cartmell-East Central).

1574 - A2, A4, B2, E2

THE EFFECTS ON RUNOFF, GROUNDWATER, AND LAND OF IRRIGATING WITH CATTLE MANURE SLURRIES

Tennessee University, Department of Agricultural Engineering, Knoxville.
J. I. Sewell, and J. C. Barker.
Research Report No. 31, Tennessee Water Resources Research Center, Knoxville, October 4, 1973, 26 p., 7 fig., 4 tab, 3 ref,

Descriptors: *Farm wastes, *Cattle, *Water reuse, Waste disposal, Slurries, *Waste management, *Organic wastes, Irrigation, Water quality, Groundwater, Surface runoff, Nitrates, Bacteria, Southeast U. S., Tennessee, Humid climates, Path of pollutants.

The manure slurry irrigation system receiving lot runoff has performed satisfactorily and has been durable. Careful management is required to maintain storage capacity for lot runoff while controlling surface runoff of irrigated slurry. Dilution water must sometimes be added to the storage tank to facilitate solids removal. Dry-matter contents of slurry up to about 4 percent did not appreciably reduce system discharge rates. Manure slurry apparently infiltrated into the shallow groundwater on the downslope side of the test area. Surface runoff from the manure-saturated area on occasions contained both total and fecal coliform median concentrations exceeding the maximum standard for raw surface water for public supplies. All median surface runoff nitrate nitrogen concentrations were within the permissible criteria. An average application rate of 5.55 tons of dry matter per acre per month applied in the form of dairy manure slurry presented no problems of solids accumulation on the ground surface. Field irrigation with the manure slurry resulted in a 98% reduction in the total solids content of surface runoff and groundwater compared with that of the slurry. (Sewell-Tennessee University).

1575 - B1, F1, F2

EFFECT OF FEEDLOT LAWS AND CLIMATE ON OPEN FEEDLOT WASTE MANAGEMENT

Department of Agricultural Engineering, Oklahoma State University, Stillwater.
A. F. Butchbaker, J, E. Garton, G. W. Maloney, and M. Paine.
Presented at 65th Annual Meeting, American Society of Agricultural Engineers, June 27-30, 1972, Hot Springs, Arkansas, Paper No. 72-438, 38 p., 12 fig., 6 tab, 16 ref.

Descriptors: *Feed lots, *Regulation, *Legal aspects, *Climates, *Farm wastes, *Management, *Design, Costs, Precipitation (Atmospheric), Storms, Evaporation, Water pollution, Irrigation, Solid wastes.
Identifiers: Storm rainfall, Open feed lot, Holding pond.

The effects of climate and the impact of feedlot laws on waste management systems were examined. Analysis of the engineering design requirements for feedlots was made by searching the literature, observing feedlot operations, performing operational analysis of waste handling systems, and from personal conversations. Feedlot laws for regulating runoff control are aimed at reducing the water pollution potential by means of holding ponds. For the waste management systems, the major climatic factors are: annual precipitation, storm rainfall, annual evaporation, and temperature. Analysis of the various alternatives for handling the feedlot waste was done by analyzing the field observations and utilizing the computer to generate design information to perform calculations for comparing the cost of various systems. For a 20,000 head open feedlot with pollution control, the total system costs (feedlot construction plus waste management systems) are approximately 0.01319 dollars per animal day with an investment cost of approximately $416,000. (Cartmell-East Central),

1576 - B1, E2, E3, F3

THE RELATIONSHIP BETWEEN ANIMAL WASTES AND WATER QUALITY

Environmental Protection Agency. President's Water Pollution Control Advisory Board.
President's Water Pollution Control Advisory Board, Environmental Protection Agency Report of Recent Meetings, October, 1971 and January, 1972. 33 p.

Descriptors: *Farm wastes, *Water quality, Recycling, Waste disposal, Lagoons, Basins, Fuels, Oil, Gases, Fertilizers, Feeds, Research and development, Feed lots, Water pollution, Runoff, Colorado, Nebraska, Kansas, Illinois, Indiana, Public health, Monitorings, Strip mines.
Identifiers: *Animal waste, Land disposal, Building materials, Refeeding, Site selection.

The Board held meetings in Colorado 26-29, Oct. 71 and in Illinois and Indiana 24-28, Jan. 72 to hear testimony on the animal waste pollution problem. Field trips were combined with both meetings. The paper summarizes the hearings. As a consequence of the meetings, the Board presented ten recommendations to EPA. That on uses of animal wastes is: "The Board believes that recycling animal wastes back onto the land is the best practical approach in most situations, particularly for smaller operators, through the use of catchment basins, lagooning systems, and/or solid waste handling techniques. There are also other possible uses which should be given full consideration. Testimony presented to the Board indicates that promising possibilities exist in converting animal wastes into fuels such as oil or back into animal feeds. It is recommended that the Environmental Protection Agency give high priority to funding for research and development projects which may develop practicable and safe alternate uses for animal wastes." (Whetsone, Parker, Wells-Texas Tech University).

1577 - D4, E3

GE OPENS RECYCLING PLANT

Calf News, Vol. 10, p. 24, 80-81, October, 1972. 2 fig.

Descriptors: *Recycling, *Arizona, *Farm wastes, *Cattle, *Feeds, Thermophilic bacteria, Proteins, Livestock, Organic wastes, Feed lots, Nutrients.
Identifiers: *General Electric Company, *Recycling plant, *Refeeding.

GE opened a test facility at Casa Grande, Arizona, on 31 August to treat the wastes from 100 head of cattle by means of thermophilic bacteria to produce a pasteurized high-protein livestock feed supplement. Cattle manure consists largely of plant fiber constituents digested only slowly by usual strains of bacteria. Results are expected by mid-1973. (Whetsone, Parker, Wells-Texas Tech University).

1578 - A1, E2

MANURE PROMOTED FOR CROPLAND

Calf News, Vol. 10, p. 18, December, 1972.

Descriptors: *Farm wastes, *Crops, *Fertilizers, Rates of application, Salts, Nitrates, Irrigation, Costs, Nebraska, Nutrients, Feed lots, Soil contamination, Water pollution, Soils, Slopes.
Identifiers: *Manure, Soil conditioner, Yields.

Manure acts as a fertilizer; buffers alkaline soils; and improves porosity, granulation, water infiltration rate, and moisture retention. Residual effects may result in a profit even where handling costs exceed one-year value. Salt accumulation should be checked. Maximum application rates recommended are 10-15 tons/acre depending on precipitation and irrigation practices. Brief notes on the same page report increased hay yields on manure-fertilized land in California anud warn of nitrate pollution in Nebraska. (Whetsone, Parker, Wells-Texas Tech University).

1579 - A6, A9

INFLUENCE OF DUST AND AMMONIA ON THE DEVELOPMENT OF AIR SAC LESIONS IN TURKEYS

Department of Veterinary Science, Wisconsin University, Madison,
D. P. Anderson, R. R. Wolfe, F. L. Cherms, and W. E. Roper.
American Journal of Veterinary Research, Vol. 29, No. 5, p. 1049-1058, May, 1968. 18 fig., 5 tab, 8 ref.

Descriptors: *Dusts, *Ammonia, Poultry, Air pollution, Mortality.
Identifiers: *Air sac lesions, *Turkeys, Feed conversions, Airsacculitis.

This experiment was undertaken to determine the effects that long exposure (10 weeks) to ammonia and dust air pollution have on turkeys living under conditions of commercial poultry production. Mortality, feed conversion, incidence of air-sacculitis, and histologic changes were the response criteria used. Four treatments were designated in terms of factor levels: A—high dust and low ammonia; B—low dust and high ammonia; C—high dust and high ammonia; and C—high dust and high ammonia; and D—low dust and low ammonia, The temperature was kept near 21°C. Increasing the dust concentration from the low to the high level caused more than doubling of the incidence of airsacculitis This occurred regardless of the mycoplasma infection rate. The turkeys exposed to treatment D were conspicious by the lack of lesions. The lesions in tissues of turkeys exposed to treatments, A, B, and C usually were loss of cilia from the columnar epithelial cells lining the lumen of the trachea, increase in mucus-secreting gobiet cells in the trachea, consolidation and inflammation in areas of the lung, lymphocytic infiltration of air sacs, and occasionally masses of caeous exudate in the air sacs. (Cartmell-East Central).

1580 - D1, E3

MARKETING POULTRY MANURE

Pennsylvania State University, University Park.
H. C. Jordan.
Presented at Proceedings of the 1969 National Poultry Litter and Waste Management Seminar, September 29-30, 1969, University of Delaware Substation, Georgetown, p. 18-23., 1 ref.

Descriptors: *Poultry,* Farm wastes, *Marketing, *Fertilizers, Drying, Bacteria, Odor, Nitrogen, Phosphorous, Additives.
Identifiers: *Manure.

Surveys were conducted in an attempt to find answers to the manure marketing problem. The questionnaire and the answers that were received are given in detail. The needs for a marketable product appear to be the following: (1) poultry manure must be dried to below 20 per cent moisture; (2) microbe count must be reduced; (3) aerobic bacteria that release CO_2 and water are the only ones that can be tolerated; (4) odor must be reduced; (5) nitrogen in the form of urea and uric acid must be fixed; (6) nitrogen, phosphorous and potash should be kept in original amount in the end product; (7) chemical and biological additives must be controlled for mushroom production; (8) the product must flow through a lawn spreader and be easy to handle; (9) the product must store without picking up water and giving off odor; (10) advertising and sale must be done without "poultry manure" in the name of the product. (Cartmell-East Central).

1581 - C2, C3

THERMAL PROPERTIES OF BEEF MANURE

Ghel Company, West Bend, Wisconsin,
R. L. Houkom, A. F. Butchbaker, and G. H. Brusewitz.
Presented at 65th Annual Meeting, American Society of Agricultural Engineers, June 27-30, 1972, Hot Springs, Arkansas, Paper No. 72-316, 34 p., 11 fig., 4 tab, 14 ref.

Descriptors: *Thermal conductivity, *Farm wastes, *Cattle, Specific heat, Bulk density, Physical properties, Chemical properties, Analysis, Equipment, Moisture content, Viscosity.
Identifiers: *Manure, *Thermal diffusivity.

Objectives of the experiment were to determine the effect of moisture content on the specific heat and thermal conductivity of fresh cattle manure, to determine the chemical and physical properties of manure for engineering application, and to estimate the thermal diffusivity of manure from experimental values of specific heat, bulk density, and thermal conductivity. Manure was analyzed at 25%, 65%, and 85% moisture levels. It was found that moisture content is statistically significant in variation of thermal conductivity. Specific heat is also dependent on moisture levels whereas thermal diffusivity appears to be independent of moisture levels. Particle density of beef cattle manure was about the same as dairy cattle manure, but particle size of the dairy manure averages larger than beef manure particles. It was also found that bulk density of manure reaches a maximum at about 65% moisture content with a great variation of bulk density and thermal conductivity between 45% and 65% moisture levels. (Russell-East Central).

1582 - A1, C2, C3, C5, E2
MANAGEMENT OF SWINE WASTE BY A LAGOON SYSTEM

Agricultural Engineering Department, Cooperative Extension Service, Washington State University, Pullman.
R. E. Hermanson, and J. L. Koon.
Transactions of the ASAE, Vol. 16, No. 6, p. 1172-1174, 1178, Nov.-Dec., 1973, 4 fig., 1 tab, 9 ref.

Descriptors: *Management, *Farm wastes, *Hogs, Lagoons, Waste treatment, Water pollution, Aerobic treatment, Anaerobic conditions, Odor, Effluent, Biochemical oxygen demand, Chemical oxygen demand, Nitrogen, Phosphorus, Bacteria, Sampling.
Identifiers: *Swine, Land disposal.

A two-stage anaerobic-aerobic lagoon system can provide a significant reduction in pollutional characteristics of swine waste. The addition of an aerated second stage to an anaerobic lagoon resulted in effluent with mean BOD and COD reductions in the aerated lagoon of 72 and 45%, respectively. A detention time of 2 weeks in the aerated lagoon resulted in average BOD and COD reductions almost equal to the 4 or 5 week detention time for the anaerobic lagoon. Total nitrogen was reduced an average of 18% for the 2 week detention in the aerated lagoon and 53% for the 9 week detention,. Although significant reduction in effluent concentrations were achieved, the end product was still quite polluted. The levels of BOD, COD, N_2, and P along with solids and color, in most states, limited the discharge of wastes from this two-stage system into receiving streams. Disposal on land was the only feasible alternative. The primary effect of the aerated lagoon was the reduction of odor and the amount of pollutants that the land was forced to handle. (Russell-East Central).

1583 - A5, B1, D4
ANAEROBIC DEGRADATION OF SWINE MANURE MIXED WITH MUNICIPAL DIGESTER SLUDGE

Associate Agricultural Engineer, Metropolitan Sanitary District of Greater Chicago, Canton, Illinois.
J. L. Roll, D. L. Day, B. A. Jones, Jr., J. T. Pfeffer.
Presented at 1973 Winter Meeting, American Society of Agricultural Engineers, Chicago, Illinois, December 11-14, Paper No. 73-4521, 15 p., 3 fig., 6 tab, 8 ref.

Descriptors: *Anaerobic digestion, *Degradation (Decomposition), *Farm wastes, *Hogs, Waste storage, Waste treatment, Odor, Physical properties, Chemical properties, Sampling, Analysis, Gases.
Identifiers: *Manure, *Swine, *Municipal digester sludge.

This study was undertaken to determine if the addition of non-lagooned digester sludge to liquid swine manure aided anaerobic activity and odor control. There were two trials lasting two weeks each and a third trial lasting forty-five days. All studies indicated that adding digester sludge to manure yielded excellent anaerobic digestion. Different manure-sludge ratios were tried, and it was found that a 2:1 manure to sludge mixture underwent the most digestion, but it also emitted the most odor. However, odor was always less when sludge was added than when manure was stored alone. So adding digester sludge to a holding pit may help control odors and aid in stabilization of the manure. It was concluded that odor control and increased degradation of waste is due to enhanced anaerobic activity. (Russell-East Central).

1584 - A1, B1, F2
PRESENT AND FUTURE ZONING REGULATIONS AFFECTING LIVESTOCK PRODUCERS

B. A. Parks.
Unpublished paper, 4 p.

Descriptors: *Zoning, *Regulation, *Livestock, *Feed lots, *Legal aspects, Locating, Water pollution, Iowa, Livestock.
Identifiers: Municipal zoning, County zoning, Nuisance laws.

At the present time there are no zoning requirements on livestock facilities in the state of Iowa. As is true for all states, Iowa has granted the right to zone to local governments. But the different types of zones permitted by law makes [illegible] mention of farming, agriculture, or livestock feeding. Presently there are three primary controls which can apply to the location of feedlots, These are Health Laws, Nuisance Laws and Water Pollution Control Laws. Enforcement of health and water pollution laws are the most effective means of control. Nuisance laws can be employed, but these are usually not effective. There are two or three changes that might be made to the existing law if it is applied to livestock production. The major change would be to recind section 358A2 which grants agricultural exemption to county zoning. As a second alternative, the agricultural exemption might be retained with an amendment added which specifically subjects livestock production to zoning controls. A third alternative could be an opinion by a court that livestock production is subject to zoning. (Russell-East Central).

1585 - B2, D4
NEW LIQUID MANURE SYSTEMS

Beef, Vol. 10, No. 8, p. 37-38, April, 1974. 2 fig.,

Descriptors: *Liquid wastes, *Waste disposal, Confinement pens, Lagoons, Effluent, Odor, Costs, Missouri, Design, Farm wastes, Waste treatment.
Identifiers: *Manure, *Flush system.

Flush systems manure handling is rapidly becoming one of the most prominent methods of waste disposal in the Midwest. The flush setup offers low original cost and promises to be relatively odor free. Many men have given their reasons of installing the flush system. Most give the reason that it is an efficient, inexpensive method of waste disposal. It is based on the concept of a single slot at the end of a concrete slab draining from the feedbank. Some have been installed in the open, while others have been in cold confinement barns, but all have proved to be satisfactory for proper removal. The effluent is flushed periodically from the slab to a lagoon. To be effective in this process, the lagoon must be loaded daily. If the lagoon is loaded at longer intervals, the bacteria action will not be effective. At least once a year the lagoon must be diluted. As a rule of thumb, about half of the lagoon should be removed and replaced with water. Perhaps the flush system will offer the best and cheapest method of waste disposal in areas where weather is not extreme. (Russell-East Central).

1586 - B1, D1
NEW ALUMINUM SLATS AND CONCRETE SLATS COMPARED

Feedlot Management, Voy. 16, No. 4, p. 10-11, April, 1974. 1 fig. 1 tab.

Descriptors: *Confinement pens, Cattle, Performance, Traction, Iowa, Tennessee.
Identifiers: *Aluminum slats, *Concrete slats.

Concrete slats have long been accepted for beef cattle feeding, but, due to the expenses and impracticality of concrete, aluminum is now being used in place of concrete. Experiments which compared aluminum and concrete slats were conducted at Alice Farm in Iowa. After three winters and two summers, data was evaluated. Results indicated that the average daily gain values for the two types of slats during the three winter tests were almost identical. Average feed conversion values were also very similar. During the summers, the gains were also similar, and although feed conversions slightly favored concrete, the difference was not significant. After numerous tests and changes, Alcoa researchers have developed the slats to the point that cattle also get the same traction as on concrete. The future of confinement feeding seems definitely to be going to aluminum slats instead of concrete. (Russell-East Central).

1587 - A1, B1
SLATS IN THE SOUTHWEST?

Editor, BEEF.
P. D. Andre.
Beef, Vol. 10, No. 1, p. 62, 70, 71, September, 1973, 3 fig.

Descriptors: *Confinement pens, *Performance, Cattle, Costs, Lagoons, Sprinkling, Waste disposal.
Identifiers: *Slats, Southwest U. S., Open feed lot.

Operational facilities are given for a confinement facility with a capacity for 10,000 head of cattle. The advantages of the confinement pen versus the open pens are given in detail. Only seven acres are needed for the confinement pen versus 30 for the open pens. Confinement, it is estimated, should save hiring two men, as compared to open lots. Since the feed truck only has to travel over seven acres rather than 30, another savings of $1,800 is listed. Among the other advantages are: more pleasant working conditions for employees, ease of handling animals, possible improvement in conversion rates and death loss, odor and fly control, pollution prevention, easier management and supervision, more consistent quality of beef, faster turnover of cattle at lighter weights, and longer total life of the facility. Severe performance slumps due to weather can also be avoided; consequently, management can project business more accurately. There is an estemated $100,000 yearly advantage for this Arizona feedlot in going to confinement over open lot. (Cartmell-East Central).

1588 - E3
NUTRITIVE CONTENT OF HOUSE FLY PUPAE AND MANURE RESIDUE

Department of Animal Science, Colorado State University, Fort Collins.
J. S. Teotia, and B. F. Miller.
British Poultry Science, Vol. 15, p. 177-182, 1974. 1 fig., 5 tab, 8 ref.

Descriptors: *Farm wastes, *Poultry, *Nutrients, *Recycling, Metabolism, Energy, Amino acids, Proteins, Analysis, Feeds, Waste treatment, Waste disposal.
Identifiers: *Manure, *House fly pupae, Refeeding.

Fresh poultry manure was inoculated with house fly eggs and incubated. Tests were then conducted to determine the energy value and feeding potential of pupae from the common housefly Musca domestica L. and/or digested poultry manure. Results showed that pupae contain high levels of many nutrients important in poultry nutrition. Analyses showed that the pupae contained 61.4% protein and 9.3% fat. The amino acid composition of pupae was similar to that of meat-and-bone meal or fish meal and was better than soybean oil meal. Results of feeding trials showed that there was no significant difference in weight gain in pupae- fed chicks from 1 day to 4 weeks of age than with those fed soybean meal. However, chicks fed digested poultry manure showed inferior food conversion. Protein and higher fiber content of the digested manure may account for the difference. The metabolisable energy value of pupae and digested manure was found to be 10:6 and 2:4 MJ/g (2528 and 580 K cal/g), respectively. (Russell-East Central).

1589 - B1, D1, F1
PIERCED STEEL PLANKING SURFACING FOR FEEDLOT RUNOFF CONTROL

Water Research Institute, South Dakota State University, Brookings.
J. L. Wiersma, C. B. Gilbertson, J. M. Madden, R. E. Larson, F. L. Shapler, et. al.
Presented at 1973 Winter Meeting, American Society of Agricultural Engineers, December 11-14, Chicago, Illinois, 16 p., 17 fig., 17 ref.

Descriptors: *Feed lots, *Runoff, *Control, Waste treatment, Farm wastes, Cattle, Economics, Water pollution, Infiltration rates, Hogs, Design, Costs.
Identifiers: *Pierced steel planking, Manure.

The concept of using pierced steel planking in a dish shaped feedlot with a porous surface on a sand bed to partially treat the liquids which had been separated from the solids proved unsatisfactory. It was unsatisfactory because the waste material from the cattle combined with their hair to form an impermeable layer on the sand and this prevented vertical water movement. However, the pierced steel lot did show certain advantages over concrete lots. Some of these advantages were: the cattle adapted readily to the steel; the surface remained stable; the surface could be cleaned easily; the surface could be cleaned when concrete lots remained frozen; the lots were cooler than concrete lots during the warm months; the lots were dust free during dry seasons; and the lots could be easily remodeled by arranging the sections differently with a tractor. The price of the steel pierced lot varies as do other surfaces with each set of conditions. (Russell-East Central).

1590 - D1, E3, E4
NUTRIENT RECOVERY: NEW CONCEPT IN WASTE HANDLING

P. D. Andre.
Beef, Vol. 10, No. 7, p. 74-76, March, 1974. 6 fig., 1 tab.

Descriptors: *Nutrient removal, *Farm wastes, *Waste treatment, Recycling, Water purification, Confinement pens, Model studies, Bacteria, Separation techniques, Irrigation, Fertilization.
Identifiers: *Waste handling, Refeeding.

In the near future, cattle feeders may begin to use a nutrient recovery system as an integral part of a confinement feeding building. Such a system has been developed and is currently undergoing experimentation. This system starts with raw manure and through a series of three stages removes the organic and inorganic nutrients for animals and field crops, ending up with clear water? In the first stage, 30% of the total available dry solids can be pulled out. The second stage, which can involve up to five steps, removes most of the remaining nutrients. The third stage is a water purification stage. The cost of such a system is very high, but experiments indicate that returns from the system can be considerably higher than the cost. The nutrient value of the extracted wastes appears to be very high, and a well balanced high protein feed is the result of the process? Although there are minor problems to overcome, the Corrall Nutrient Recovery System's designers are confident that it will offer substantial gains for confinement feeding. (Russell-East Central).

1591 - B1, D1, E2
PNEUMATIC TRANSPORTATION OF MANURE

Manager Laboratory of Mechanization, All-Union Research Institute of Cattle-breeding, Podolsk, Moscow Region, USSR.
A. N. Shimko.
Transactions of the ASAE, Vol. 16, No. 6, p. 1170-1171, Nov.-Dec., 1973. 1 fig. 3 ref.

Descriptors: *Waste treatment, *Waste storage, Fertilizers, Nutrients, Economics, Organic wastes.
Identifiers: *Manure, *Pneumatic transporation, Holding tanks, Manure pits, Land spreading.

In Russia, the work involved in loading, unloading, and transporting manure accounts for approximately 40% of all the labor expended on farms. About one-half of this amount is required for handling manure. At the Mechanization Laboratory of the All-Union Research Institute of Cattle-breeding, a pneumatic system was designed to transport and load manure into storage structures on livestock farms of 100 to 2,000 head of cattle. This system eliminated tractors, transport units, and traffic in moving manure from barns to pits. It also provided the means to convey, receive, and store for long periods high quality organic fertilizer without the loss of nutrients. The system involves transportation of manure from barns to the manure bank. When the tank is full, it becomes pressurized to about 6 atmospheres. The manure is then sent through a pipeline and stored at the bottom of a pit. The upper layers of the pit dry and reduce odors. When needed, the top layers are removed and used for fertilizer. (Russell-East Central).

1592 - B2, D4
ANAEROBIC DIGESTERS AND LAGOONS

Oregon State University, Corvallis.
T. L. Willrich.
Unpublished paper, 1971, 3 p.

Descriptors: *Anaerobic digestion, *Lagoons, Waste storage, Waste treatment, Sludge, Municipal wastes, Odor, Groundwater pollution, Waste storage, Organic wastes, Costs.
Identifiers: Manure.

The anaerobic digester is used to treat solids and scum that are removed from municiual sewage, and it is used to treat animal manure. The anaerobic lagoon is usually used for the storage or treatment, or both, of some industrial organic wastes and animal manure. The anaerobic digester involves a closed vessel, capture of gases, heating, daily sludge removal, and continuous mixing. The anaerobic lagoon involves an open impoundment, release of odorous gases, no artificial heat, sludge accumulation, no controlled mixing. The anaerobic lagoon is an inexpensive device for the temporary storage of manure or the primary treatment of manure, or both. The limitations and advantages of the anaerobic lagoon are listed. Also recommendations for the design of the anaerobic lagoon are given. (Cartmell-East Central).

1593 - A1, D1
DUNG BEETLES: BIOLOGICAL WEAPON AGAINST HORN FLIES

S. A. Sanchez.
The Cattleman, p. 76-77, March, 1973. 2 fig.
Descriptors: *Farm wastes, Texas, Cattle, Australia, Waste treatment, Diseases.
Identifiers: *Flies, *Manure, *Dung beetles.

A species of Afro-Asian dung beetle, Onthophagus gazella, introduced to South Texas from Australia, shows promise of helping control manure-breeding flies that affect cattle. Under optimum conditions, a cow dropping can be broken down in 24 hours through the cooperative efforts of about 50 conjugal pairs of beetles. Onthophagus appears to be able to survive winter weather and droughts. The beetle operates by working beneath the manure, breaking it down and burying it in underground tunnels. Being a night flier, it is less subject to such predators as cattle, egrets, meadowlarks, toads, and wild turkeys. It is also less apt to become an intermediate host of parasites than are day crawling insects. (Whetsone, Parker, Wells-Texas Tech University).

1594 - E2
EFFECT OF CAGED-LAYER MANURE ON PASTURE LAND

North Carolina State University, Raleigh.
D. B. Harwood, T. B. Morris, Jr., G. A. Martin, J. A. Phillips, and J. V. Gaird.
Unpublished paper, 1973, 4 p.

Descriptors: *Farm wastes, *Poultry, *Pastures, Fescues, Fertilizers, Clovers, Rates of application, Litter, North Carolina, Costs, Forage grasses.
Identifiers: *Caged-layer manure, Yield.

In 1969, the authors solicited the cooperation of Maurice and Eugene Pickler of Springdale Farms, Inc., in conducting field trials of application rates of coned caged layer manure on pasture land. The farm had been seeded to tall fescue and ladino clover several years earlier, had been generally underfertilized and overgrazed, and had become a mixed sod of species seeded and native grasses and clovers. The experimental area was divided into four plots. 600 lbs./A of 16-16-16 fertilizer was applied to Plot 1; 5 tons/A of manure from caged hens was applied to Plot 2; 10 tons/A of the manure was applied to Plot 3; and 15 tons/A of the manure was applied to Plot 4. Measurement of forage was taken at irregular intervals. Yield was increased 28, 48, and 118% by the addition of 5, 10, and 15 tons of coned cage manure on alternative years. At the low rate of application, carry-over effect was only 14% of direct effect, but at the higher application rates, carry-over effect was more than 60% as large as direct effect. At 50c/lb. of beef, the yield would be worth $30.80 per ton of manure, or, at 30c/lb. of beef, the yield would be worth $18.48 per ton of manure applied. (Cartmell-East Central).

1595 - D1, E2, E3
AIR DRYING OF POULTRY MANURE UNDER FULLY STEPPED CAGES IN DEEP PIT HOUSES

Durham, England.
H. A. Elson, A. W. M. King, and C. L. Benham.
Unpublished report, March, 1972, 4 p. 6 taab.

Descriptors: *Drying, *Poultry, *Farm wastes, Waste treatment, Waste disposal, Feeds, Fertilizers, Recycling, Molds, Moisture content, Bacteria, Proteins, Nitrogen, Phosphorus, Postassium, Larvae.
Identifiers: *Manure, *Deep pit houses, Slats, Refeeding.

In order to use or dispose of poultry manure, it is logical to consider drying it since this considerably reduces its mass and renders it more convenient to handle. In a search for an economical and efficient method of drying manure, trials were set up, in which slats of various widths were installed under cages. Samples of manure were taken every two months and analyzed for moisture content, molds, pathogenic bacteria, fly larvae, fertilizer and feeding values. With regard to fertilizer value, an analysis of a typical sample was: dry matter 74.1%, nitrogen 8.80%, phosphorus 2.13%, potassium 2.19%, $CaCO_3$ 5.30%. The feeding value of this sample was crude protein 29%, crude fiber 12.2%, oil 1.0%, ash 25.4%. It was concluded that this method of utilizing slats under cages to dry poultry manure had proved efficient and economical. The narrower the slat, the quicker the drying takes place; the narrower the gap the quicker the manure bridges it—preventing further drying. Subject to certain limitations, the dried material is suitable for use as a feed or fertilizer, which considerably enhance its value. (Cartmell-East Central).

1596 - D1, E3

THE NUTRITIONAL VALUE OF HYDROLYZED POULTRY MANURE FOR BROILER CHICKENS

Division of Poultry Husbandry, Georgia University, College Experiment Station, Athens.
K. E. Wehunt, H. L. Fuller, and H. M. Edwards, Jr.
Poultry Digest, Vol. 39, p. 1057-1663, 1960. 5 tab, 17 ref.

Descriptors:*Hydrolosis, *Poultry, *Farm wastes, Performance, *Feeds, Growth rates, Litter.
Identifiers: *Nutrition, *Manure, *Broiler chickens, *Refeeding.

The objective of this study was to determine the value of hydrolyzed poultry manures as ingredients in broiler diets by obtaining a measure of the bilogical value of their protein, and by determining their unidentified growth factor activity in comparison with recognized sources of such factors. The results indicated that chicks can utilize a portion of the protein of hydrolyzed broiler litter when it is added to diets that are sub-optimal in protein. The chicks receiving supplemental protein from manure required more crude protein per gram gain in body weight than those receiving equal amounts from the other sources. Thus, on the basis of crude protein, the manures were less efficient than either soybean oil meal or the casein-gelatin combination. Based on chemical determination performed during this investigation, only about one-half of the crude protein of hen manure and slightly more than one-third of that of broiler manure existed as true protein. It appeared that autoclaved poultry manure was approximately equal to condensed fish solubles and dried distillers' solubles combined, and superior to either in supplementing corn-soybean oil meal type rations containing no other UGF supplements, as such. (Cartmell-East Central).

1597 - B1

SPRINKLING CATTLE FOR CONTROL OF HEAT STRESS

Department of Agricultural Engineering, California University, Davis.
S. R. Morrison, R. L. Givens, and G. P. Lofgreen.
California Agriculture, Vol. 27, No. 8, p. 7-9, August, 1973. 1 fig., 4 tab.

Descriptors: *Sprinkling, *Cattle, *Control, *Heat, *Temperature, Refrigeration, Performance, Mud.
Identifiers: *Heat stress, Slotted floors, Space.

Two studies were conducted at the Imperial Valley Field Station. In one study cattle were sprinkled for 1 minute every 30 minutes when the temperature was above 80°F, or they were housed in a refrigerated barn maintained at 75°F. Results of this first experiment showed cattle cooled by either refrigeration or by sprinkling ate significantly more feed and gained weight faster than did the uncooled control cattle. However, efficiency of feed conversion was not greatly affected. The control cattle were under some degree of heat stress, as their respiratory rates and body temperatures were higher than those of animals cooled by refrigeration or sprinkling. In experiment two, both uncooled and cooled cattle consumed more feed and gained more weight when alloted 40 sq. feet per head of space than with 20 sq. feet. Other results were fairly comparable to experiment one. (Cartmell-East Central).

1598 - A1, B1

POSSIBILITY OF REDUCING NITROGEN IN DRAINAGE WATER BY ON FARM PRACTICES

Department of the Interior, Bureau of Reclamation, Fresno Field Division, Fresno, California.
J. W. Williford, and D. R. Cardon.
Agricultural Wastewater Studies, 1971. Report No. REC-R2-71-11, 83 p., 18 fig., 31 tab, 23 ref.

Descriptors: *Nitrates, *Agricultural waste, *Fertilizers, Lysimeters, Sub-surface drainage, Denitrification, Ammonia, Crop production, Animal wastes, Municipal wastes, Nitrogen.
Identifiers: *San Luis Service Area, California, *Nitrogen Budget, Mineralization, Organic nitrogen, Drainage water, Farm practices.

A nitrogen balance study of the San Luis Service Area determined that the average annual nitrogen contributions from all sources other than residual soil nitrogen were approximately equal to the nitrogen removal by crops and gaseous losses. This would indicate that, although in many instances the residual-nitrates would replace some of the contributed nitrogen, especially fertilizers, animal and municipal wastes, the amount of nitrates moved to the drains would be proportional to the amounts of soluble, native nitrates in the soil. A soil sampling study at several sites throughout the area indicated that there were a wide range in the concentrations of nitrates, ammonia and organic nitrogen in the soils and subsoil. There were extremely high concentrations of nitrates in those soils located on the interfan positions between the larger streams. Fertilizer studies in lysimeters show that in medium to heavy textured soils under normal irrigation and fertilizer management practices very little nitrogen is leached to the drains. Nitrate type fertilizer contributed more nitrogen to the drainage effluent than ammonia and slow release sulfur coated urea fertilizers. It was concluded that the best possibilities to reduce nitrogen in drains by on farm practices will be to establish Farm Advisory Programs to encourage the most efficient farm management and fertilizer practices and to design drain systems to promote denitrification and reduce the area swept by the drain flow lines. (Williford-U. S. Bureau of Reclamation).

1599 - B1

RESPONSIBILITIES OF CONSULTING ENGINEERS IN PREPARING LIVESTOCK WASTE MANAGEMENT PLANS

Nebraska University, Lincoln.
W. A. Olson,
Extension Service, University of Nebraska, Lincoln, November, 1972, 2 p.

Descriptors: *Livestock, *Farm wastes, *Management, Feed lots, Design, Wells, Topographic mapping, Planning.
Identifiers: *Consulting engineers, Cost sharing, Debris basin, Holding pond.

Eleven steps were given for consulting engineers in preparing livestock waste management plans. In short, they include: (1) prepare a topographic map of existing or proposed feedlot areas; (2) prepare a topographic map showing the total land area to be used for disposal of feedlot waste; (3) prepare a design for the livestock waste management system; (4) discuss management aspects of proposed system with operator; (5) discuss with operator cost-sharing from ASCS; (6) make the operator aware of existing feedlot problems; (7) check on quality of drinking water from domestic wells; (8) include with plans completed Department of Environmental Control Forms; (9) engineer should prepare the field layout; (10) provide recommendations for sealing the debris basin and holding pond; (11) prepare written contract between the consulting engineer and operator. (Cartmell-East Central).

1600 - A1, E2

ACCUMULATIVE EFFECTS OF MANURE AND N ON CONTINUOUS CORN AND CLAY SOIL. 1. GROWTH, YIELD, AND NUTRIENT UPTAKE OF CORN

Department of Plant and Soil Science, Vermont University, Burlington.
J. L. McIntosh, and K. E. Varney.
Agronomy Journal, Vol. 64, No. 3, p. 374-379, May-June, 1972. 3 fig., 8 tab, 12 ref.

Descriptors: *Farm wastes, *Nitrogen, *Corn (Field), *Soils, *Growth rates, *Nutrients, Physical properties, Chemical properties, Potassium, Magnesium, Calcium, Moisture, Rainfall.
Identifiers: *Manure, *Yield, Mineral composition.

The objectives of the study were to study the effects of continuous corn and manure and N treatments on the physical and chemical properties of the soil and on the growth, yield, and mineral composition of the corn plants over a period of at least 5 years. The results are reported in this paper. During years of normal or less than normal rainfall, manure application significantly increased yields of corn grain and stover. During relatively wet years, manure had no beneficial effect on corn growth and yield. Manure treatments increased percentage K by as much as 0.30% in the corn ear leaves but decreased Ca and Mg. Manure had little effect on percentage N and P. In a wet year, manure reduced N from 2.72 to 2.44% when averaged over all treatments of N. Chemical analysis of small plants showed the same trends as did analysis of ear leaves. Manured plots were slightly but consistently higher in soil moisture. Small differences of about 1% were measured when the soil was near saturation (43% moisture). Differences of 2.5% were measured 1 week later when the soil was near 30% moisture. (Cartmell-East Central).

1601 - B2

SUBFLOOR MONITORING OF SHADY GROVE DAIRY LIQUID MANURE HOLDING POND

Farm Advisor, California University Extension Service, San Bernadino County.
J. C. Oliver, W. C. Fairbank, J. L. Meyer, and J. M. Rible.
California Agriculture, Vol. 28, No. 4, p. 6-7, April, 1974. 1 fig., 6 tab.

Descriptors: *Monitoring, *California, *Dairy industry, *Liquid wastes, *Sealants, *Seepage control, Analysis, Chemical properties.
Identifiers: *Subfloor, *Manure *Holding pond.

Subfloor monitoring of the Shady Grove Dairy liquid manure holding pond was begun in June, 1972, with the installation of duplicate tensiometer cups at 2, 4, 6, 8, and 9 ft. below the pond floor. Extracts for analysis were collected weekly from ceramic cups for the first six weeks after the pond was filled with manure water. Chemical analyses of soil solution extracts from beneath the pond were given. This subfloor monitoring technique established that the dairy waste pond had become effectively sealed. The soil solution analysis as compared with original soil analysis data, leads to the conclusion that sealing of ponds takes place essentially in the upper 6 ft. of soil in a pond bottom. (Cartmell-East Central).

1602 - A1, B1

SPRINKLING FOR DUST SUPPRESSION IN A CATTLE FEEDLOT

Agricultural Experiment Station, Department of Agricultural Engineering, California University, Davis.
J. J. Carroll, J. R. Dunbar, R. L. Givens, and W. B. Goddard.
California Agriculture, Vol. 28, No. 3, p. 12-14, March, 1974. 4 fig.

Descriptors: *Sprinkling, *Dusts, *Feed lots, *Cattle, Temperature, Humidity, Dew point, Performance, Odor, Mortality, Morbidity, California.
Identifiers: Flies.

This report summarizes an investigation of the effectiveness of sprinkling open, unpaved, feedlot cattle pens for dust control, and the effect of sprinkling on the temperature and relative humidity. One sprinkled feedlot and one unsprinkled feedlot, located in the Imperial Valley of California, were studied. A program of sprinkling the pens for 2 hours, beginning at 1 pm PDT and again for 1½ hours beginning about 5 pm PDT, should reduce the total dustiness by at least half. Sprinkling appears to reduce the maximum temperature reached for the day less than 10°F while raising the ambient relative humidity by not more than about 10%. No deleterious effects on animal performance, morbidity, or mortality resulted from sprinkling. No increase in fly or odor problems could be traced to sprinkling. (Cartmell-East Central).

1603 - B1

DRINKING WATER CONTROL IN DEEP PIT LAYING HOUSES

Agricultural Experiment Station, Maine University, Orono.
F. V. Muir, G. B. Jaeger, and H. C. Whelden, Jr.
Research in Life Sciences, Vol. 20, No. 4, 4 p., September, 1972. 3 tab, 3 ref.

Descriptors: *Poultry, *Water, *Control, Waste storage, Farm wastes, Flow control, Waste disposal.
Identifiers: *Water supply, *Deep pit laying houses, *Flow-through trough.

Commercial poultry houses designed with a deep pit provide a manure storage area which permits greater flexibility in manure disposal alternatives. Manure can be allowed to accumulate in the pit for a time period in excess of one year. The method of watering the layers in the houses has been an intermittent flow-through system. Three trials were conducted to determine the consistency of flow rates from flow control valves; to measure flow rates from ¾ gallon per minute flow control valves installed in varying locations in a 4-row double deck, deep pit cage system; and to measure the time required for water to flow from the inlet to the overflow end of trough waterers. The results indicated that flow control valves can be used in commercial poultry houses to equalize the flow rate into the individual trough of an intermittent flow-through watering system. (Cartmell-East Central).

1604 - A2, A4, E2

POLLUTIONAL ASPECTS AND CROP YIELDS RESULTING FROM HIGH MANURE APPLICATIONS ON SOIL

Agricultural Engineering Department, Nebraska University, Lincoln.
O. E. Cross.
Presented at 67th Annual Meeting of American Society of Agricultural Engineers, Oklahoma State University, Stillwater, June 23-26, 1974, Paper No. 74-4059, 29 p., 21 fig., 1 tab, 13 ref.

Descriptors: *Water pollution, *Rates of application, *Soils, *Farm wastes, *Waste disposal, Runoff, Groundwater pollution, Feed lots, Cattle, Nitrates, Irrigation, Sodium, Potassium, Electrical conductance.
Identifiers: *Crop yields, *Manure, Land spreading.

Beef cattle manure was applied on the test sites at levels of 0, 40, 80, and 160 tons per acre for four years. The sites were plowed at depths of 4, 8, and 12 inches. Crops were planted on the sites at three plant densities: "low", "medium", "high". The crops were then irrigated, and data was gathered concerning crop response, pollution of underground water supply, and pollutional potential from surface runoff. It was found that plant densities or plow depth had no effect on crop yield, and over the four year period crop yield had not decreased on sites where manure was added. The underground water appeared to have retained its potable quality throughout the test. Nitrogen displacement in the runoff exceeded the potable water allowable of 10 ppm only during the first 90 minutes of irrigation on heavily manured sites. The sodium concentration of the runoff never exceeded the maximum for potable water, but it is acceptable to be reused for irrigation. Also electrical conductance was never above Water Quality Standards. Results indicate that runoff from manured areas can be reused as irrigation water. (Russell-East Central).

1605 - B2, D4, F1

SWINE WASTE MANAGEMENT SYSTEMS

Agricultural Engineering Department, Purdue University, West Lafayette, Indiana.
B. Horsefield, J. Gottbrath, and J. Kadlec.
Presented at the 1973 Winter Meeting of the American Society of Agricultural Engineers, Chicago, Illinois, December 11-14, 1973, Paper No. 73-4517, 33 p., 9 fig., 10 tab, 15 ref.

Descriptors: *Hogs, *Farm wastes, *Waste treatment, *Management, *Evaluation, Costs, Lagoons, Confinement pens, Economics, Waste storage, Separation techniques, Transfer, Transportation, Waste disposal, Odor, Water pollution, Irrigation, Performance.
Identifiers: Oxidation ditch, Slatted floors, Collection, Land disposal.

Five unique waste handling systems for confinement finishing hogs were studied and were compared with two common systems. The five systems were: (1) a deep pit with wood slats and earth bottom; (2) partial wood slats, a shallow pit and a two-stage lagoon; (3) full wood slats with a shallow pit and lagoon; (4) a solid concrete floor with flushing and a two-stage lagoons; and (5) partial slats and air diffusion oxidation. The two common systems were: (A) concrete slats and concrete pit; and (B) concrete slats and pit with oxidation ditch and outside storage. Both cost and noncost factors were taken into consideration. The costs ranged from $.75 to $3.89 per head produced if the nutrient value of the wastes were ignored. (Russell-East Central).

1606 - A1, E3, F2

CONTROL OF POLLUTION FROM ANIMAL FEEDLOTS AND REUSE OF ANIMAL WASTES

Committee on Governmental Operations.
93rd Congress, 2nd Session, House Report No. 93-1012, 68 p., 1 fig.

Descriptors: *Water pollution, *Control, *Feed lots, *Farm wastes, *Livestock, Legal aspects, Permits, Regulation, Fertilizers, Fuels, Recycling, Waste treatment, Waste disposal, Cattle.
Identifiers: *Pollution, *Reuse, Environmental Protection Agency.

This report looks at the Federal Government's efforts to control pollution from animal feedlots by more efficient management of wastes and by encouragement of their reuse as fertilizer and fuel. It discusses the nature of feedlot pollution from feedlots, and the current EPA policies for control. Also discussed is the pollution problem versus the administrative problem. A lengthy portion deals with permit requirements for point source pollutors. Three appendices discuss the types of animal feedlots, the EPA's authority to exclude point sources from the permit program, and a photograph of a beef cattle feedlot, respectively. Supplemental views of Hon. John C. Culver and dissenting views of Hon. Charles Thone are included. (Russell-East Central).

1607 - E3, F1, F2

$500,000,000, MARKET—IF FDA SAYS OKAY

C. Cooper.
Egg Industry, Vol. 6, No. 7, p. 15, 18, 20-21, July, 1973. 3 fig.

Descriptors: *Farm wastes, *Poultry, *Feeds, *Recycling, *Waste treatment, Moisture content, Proteins, Nutrients, Costs, Performance, Dehydration, Drying.
Identifiers: *Dried poultry waste (DPW), Food and Drug Administration, Pasteurization.

A half-billion dollar market for DPW (dried poultry waste) as a feed ingredient may be just around the corner if the Food and Drug Administration yields to pressure from many industry sources, and on Capitol Hill, to recognize it as a safe and effective feed additive. Major roadblock to final FDA sanction is the promise of that intense fight from consumer groups. Various other countries are already utilizing DPW as a feed ingredient. Smaller eggmen will have the option of purchasing smaller driers and processing their own wastes or selling the raw manure to a bigger operator. Most scientists agree that the lower the moisture content of the raw manure when it's fed into the drier, the better. But, they also agree that if poultry manure is left in the houses for more than three days, the protein value of DPW deteriorates, bringing down with it the expected selling price. Reducing the cost of producing a dozen eggs by one per cent of feed cost, through quality control in the feed mill, can mean a $17.3 million dollar savings to the egg industry. (Cartmell-East Central).

1608 - B1, D1

SETTLING BASIN DESIGN FOR RACEWAY FISH PRODUCTION SYSTEMS

Agricultural Engineering Center, Georgia University, Athens.
J. L. Chesness, W. H. Poole, and T. K. Hill.
Presented at the 67th Annual Meeting of American Society of Agricultural Engineers, Oklahoma State University, Stillwater, June 23-26, 1974, Paper No. 74-5005, 13 p., 3 fig, 5 tab, 8 ref.

Descriptors: *Settling basins, *Design, *Organic wastes, *Fish, *Sedimentation, Recirculated water, Model studies, Effluent, Analysis.
Identifiers: Raceway fish production systems, *Fish wastes.

A new type of fish production system is a flowing water culture of fish in a recirculating earthen raceway. This system produces substantial amounts of fish, but if production in this closed-loop system is to continue, techniques must be found for the removal of waste products. This study was undertaken to: (1) determine the quantity of solids and the settling characteristics of suspended solids; and (2) design and test a settling basin for the removal of these solids. A trapezoidal-shaped settling basin was designed. Field evaluations showed that the basin would remove about 40% of the filterable solids. This was 82% of the predicted removal efficiency, but only 6% of the total organic solids would be removed by sedimentation. This study indicates that effective removal of waste organics in warm water fish culture recirculating raceway systems cannot be attained by physical sedimentation alone. (Russell-East Central).

1609 - A1, B2, E2

DEVELOPMENT OF AN ORGANIC WASTE SLURRY INJECTOR

Department of Agricultural Engineering, Colorado University, Fort Collins.
R. C. Gold, and J. L. Smith.
Presented at Winter Meeting, American Society of Agricultural Engineers, Chicago, Illinois, December 11-14, 1973, Paper No. 73-4529, 12 p. 6 fig., 15 ref.

Descriptors: *Farm wastes, *Organic wastes, *Waste disposal, *Slurries, *Injection, Irrigation, Odor, Aesthetics, Economics, Ground water, Runoff, Soil analysis, Insects.
Identifiers: *Land spreading, Pollution, Deep plowing.

Organic waste disposal methods have changed little over the past several decades. However, these usually create aesthetic and pollution problems which have resulted in an attempt to find new and better ways to dispose of organic wastes. The presence of organic matter and some plant nutrients makes the idea of recycling organic wastes to the soil very desirable. The four usual methods for returning materials to the soil are irrigation, surface spreading, deep plowing or burial, and shallow plowing or injection. Since surface application creates problems, experiments were conducted using a slurry injection system. This type of system offers these advantages: (1) it is inexpensive; (2) it is capable of handling large volumes of wastes; (3) it eliminates odors, visibility, and aesthetic pollution problems; (4) it can be used in any part of the country with sufficient storage capacity for cold weather; (5) it can be operated by one person; and (6) the wastes are recycled and their benefits are not lost. (Russell-East Central).

1610 - B1, E2, F1

TAILOR MADE CONFINEMENT BARN

Managing Editor of BEEF.
B. Fleming.
Beef, Vol. 10, No. 7, p. 8-9, March, 1974. 4 fig.

Descriptors: *Farm wastes, *Confinement pens, *Management, Fertilizer, Design, Oxidation lagoons, Lagoons, Costs, Ventilation, Insulation, Waste disposal, Waste storage, Odor.
Identifiers: *Barns, Land spreading, Slats.

A confinement barn operation should fit a feeder's personal needs. Lee and Roy Stoll had that in mind when they designed their own confinement barn. It consisted of a 256 ft. long barn. The south side of the barn was always open. The cattle were fed by a 250 ft. belt feeder which ran down the middle of the building. The manure handling system consisted of an eight ft. deep pit system. The manure was then reclaimed as fertilizer at an estimated savings of about $23 per acre. Other unique arrangements in the barn were varied pen size and slats for the background lot. The Stolls eliminated drafts by using wall-like dividers and insulation. The manure pit was eight ft. deep, but only about two feet of that was below grade. The rest was built above ground and then fill dirt was added. The stall operation is a carefully matched setup, and is tailored for their specific operation. (Russell-East Central).

1611 - A1, D4, E1

METHODS OF REMOVING NITRATES FROM WATER

Robert S. Kerr Research Center, Ada, Okla.
P. P. St. Amant, and L. A. Beck.
Journal of Agriculture and Food Chemistry, Vol. 18, No. 5, p. 785-788, September-October, 1970. 1 tab, 7 ref.

Descriptors: *Nitrates, *Water, *Algae, *Bacteria, *Denitrification, *Desalination, *Nitrogen, *Nitrates, Oxidation, Costs, Tile drainage, Osmosis, Electrodialysis, Proteins, California, Filters.
Identifiers: *Algae stripping, Pond.

Due to salt accumulation in the water collected by tile systems in the California San Joaquin Valley, it is necessary to dispose ultimately of this water. Reports show that nitrogen, primarily in the nitrate form, is a serious potential pollutant. [illegible] basic methods of nitrogen removal are being evaluated at the Agricultural Waste Water Treatment Center. These methods are termed bacterial denitrification and algae stripping. Two methods of bacterial denitrification are being evaluated: pond denitrification and filter denitrification. Desalination of the tile drainage is also used. The report has explanations of each method. Also, the efficiency of each method is discussed. Land requirements for these three systems will vary greatly. Initial cost estimates for nitrogen removal by these three biological systems are nearly the same—around $25 to $30 per million gal. based on an average influent nitrate-nitrogen concentration of 20 mg per 1. (Cameron-East Central).

1612 - E3

CAN WE REFEED FEEDLOT WASTES?

E. Wilborn.
Progressive Farmer, Vol. 89, No. 3, p. 58, March, 1974. 1 fig.

Descriptors: *Recycling, *Farm wastes, *Feed lots, Cattle, Livestock, Performance, Costs, Odor, Waste treatment, Waste disposal, Feeds.
Identifiers: *Refeeding.

Now research is proving that feedlot wastes can be an important source of livestock feed. Sevetral important developments on the subject were reported at the winter meeting of the American Society of Agricultural Engineers in Chicago. Beef cows can be trained to eat pelleted feedlot manure mixed with barley as a supplement to dry pasture feeding. Three groups of pregnant Hereford cows were fed on dry range for 84 days. One group's diet was supplemented with pelleted cottonseed meal; one with a pelleted mixture of 75% feedlot manure and 25% barley; and one group received no diet supplement. Cows given the manure-barley pellet had a higher body weight than cows given the cottonseed meal supplement. Costs for refeeding operation were lower than for a standard feedlot operation but initial investment and labor for the refeeding operation were higher. Odor reduction and solving of environmental pollution problems are two benefits. (Cartmell-East Central).

1613 - C1, D1, E3

SOME REFLECTIONS ON DRIED POULTRY WASTE

California University, Riverside.
M. H. Swanson.
Poultry Digest, Vol. 33, No. 385, p. 118-121, March, 1974. 2 fig., 13 tab.

Descriptors: *Farm wastes, *Poultry, *Drying, *Recycling, Fertilizers, Fuels, Performance.
Identifiers: *Refeeding, Dried poultry waste (DPW).

Agricultural and food processing wastes, including those from poultry, have three principal alternative uses: (1) as fertilizers and soil amendments; (2) as feed ingredients for recycling through livestock and poultry; (3) as sources of fuel (energy). Poultry wastes as fertilizers and fuel are discussed briefly. A more profitable potential for utilization of poultry waste is the recycling of the product as a feed ingredient. Complete composition of dried poultry waste is given. Modification in the composition of poultry droppings occurs during the holding period prior to artificial drying and during the drying period itself. Indigestible components are rendered digestible through bacterial action and chemical breakdown. Exposure of the product to too high a temperature reduces its nutrient value. Total nitrogen and crude protein values for DPW are high. DPW is a low energy product. When DPW was fed to laying hens, egg size and shell thickness was reduced with increasing levels of DPW. But the addition of DPW did produce higher albumen quality. The use of dried poultry waste in some poultry rations may result in reduced costs; still greater savings can be realized by using DPW in ruminant rations. (Cartmell-East Central).

1614 - A2, C3

WATER QUALITY OF STORM RUNOFF FROM A TEXAS BEEF FEEDLOT

Abraham Baldwin Agricultural College, Tifton, Georgia.
G. G. Wise, and D. L. Reddell.
Presented at 66th Annual meeting, American Society of Agricultural Engineers, University of Kentucky, Lexington, June 17-20, 1973, Paper No. 73-441, 23 p., 9 fig., 5 tab, 23 ref.

Descriptors: *Water quality, *Storm runoff, *Texas, *Cattle, *Feed lots, Measurement, Sampling, Drainage area.

A study of feed lot runoff was conducted for nine months on a 10,000 head feed lot. Over 250 runoff samples were collected from 11 natural storms on two drainage areas. Approximately .5 inch of rainfall was generally required to initiate runoff. Relationships between volatile solids, total solids, and chemical oxygen demand were established. Storm pattern and size had little effectt on the average concentration of a chemical element. Chemical oxygen demand, phosphorus, and Kjeldahl nitrogen followed the variations in total solids concentrations. Potassium, sodium, and chloride and filterable solids were not related to the sediment load. Most chemical constituents' concentrations were greater from area one than from area two, probably because of a greater slope at area one. (Frantz-East Central).